RMT

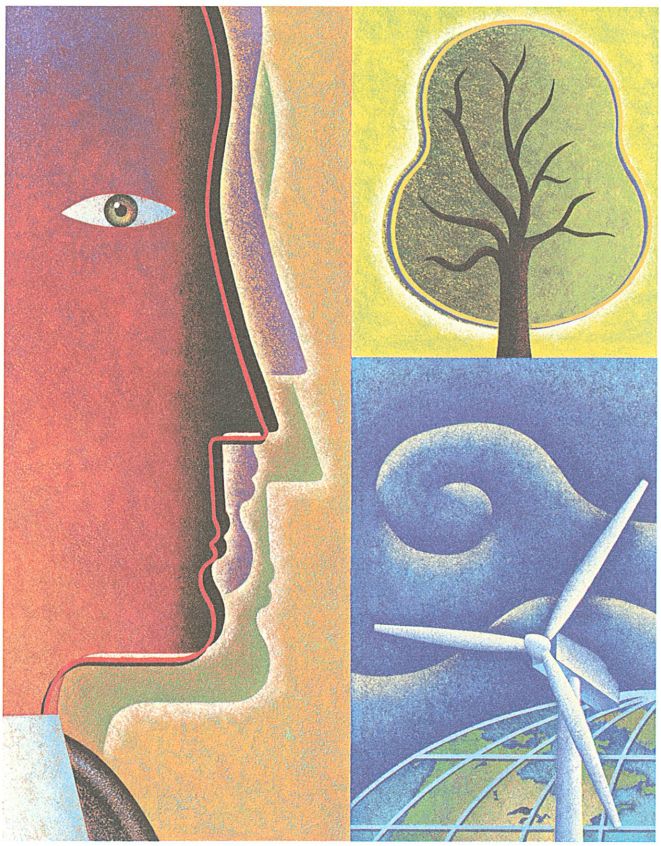
• ENVIRONMENT • ENERGY • ENGINEERING

Remedial Design (RD) Report Addendum No. 1

Dayco Corporation / L.E. Carpenter Superfund Site
Borough of Wharton, Morris County, New Jersey

USEPA ID No. NJD002168748

August 2008



RMT

• ENVIRONMENT • ENERGY • ENGINEERING

Remedial Design (RD) Report Addendum No. 1

Dayco Corporation / L.E. Carpenter Superfund Site
Borough of Wharton, Morris County, New Jersey

USEPA ID No. NJD002168748

August 2008

Ken Quinn for
Senior Consultant

James J. Dexter
Senior Hydrologeologist

Nicholas J. Clevett
Project Manager

Jennifer Overvoorde
Staff Hydrogeologist

Table of Contents

List of Tables

List of Figures

List of Appendices

Section 1
Introduction

1.1 Background

RMT, Inc. (RMT), on behalf of L.E. Carpenter and Company (LEC), has prepared this Remedial Investigation Workplan (RIW) for LEC ("site") located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey (Figure 1). We have certified this report in accordance with requirements outlined in N.J.A.C 7:26E-1.5 (Appendix A).

On June 25, 2008, LE Carpenter (LEC) received a Notice of Deficiency (NOD) letter dated June 19, 2008 from the New Jersey Department of Environmental Protection (NJDEP). As stated in the June 19 NOD, the NJDEP requires LEC to take a Corrective Action consisting of submitting a Remedial Investigation Workplan (RIW) within 60 days after receipt of the NOD. Specifically, this RIW outlines work that will take place in order to "delineate groundwater contamination in the vicinity of MW-30s," and "identify source(s) areas that are degrading surface water quality in the ditch and the Rockaway River." This RIW satisfies the requirements contained in the June 19 NOD.

The Description of Deficiency states that "*Pursuant to Paragraph 29 of the Administrative Consent Order (ACO), failure to conduct additional remediation as directed and to submit subsequent Remedial Investigation Reports and Remedial Action Reports in Accordance with N.J.A.C. 7:26E as applicable*." LEC disagrees with this statement. Any notion of a deficiency is in error. LEC has worked very closely with both United States Environmental Protection Agency (USEPA) and NJDEP on all matters related to the LEC Wharton project, and we have always been in full compliance with, and have submitted all reports as required by the ACO. As we explained during many telephone conversations and e-mails, we regularly requested NJDEP Division of Land Use Regulation (DLUR) and Bureau of Case Management to review and expedite issuance of the requisite wetland and stream encroachment permits in order to complete the Post Remediation Monitoring Plan (PRMP) that NJDEP approved. It was critical to obtain data from all of the PRMP wells, especially the downgradient wetland wells, in order to adequately evaluate the efficacy of the Source Reduction remediation and move the project forward (see discussion in the following paragraphs for additional details and how this matter directly pertains to the content of this RIW). As described further below, the requisite permits were finally received in February 2008, and the wells were installed shortly thereafter. Based on our technical review of the data from the new wetlands wells that are now available (from a one-time sampling event) we have determined that the data are most pertinent to the tasks included within this RIW, and they have been duly incorporated herein. Based on these new data, the need for, and content of,

this RIW is now more apparent, and the timing for its completion is appropriate, although not under the auspices of any type of "deficiency."

The June 19 NOD letter acknowledges receipt of Remedial Action Progress Reports (RAPRs) for each quarter of a year beginning with the 2Q06 report and the most recent being the 1Q08 report. However, the NJDEP June 19 letter does not acknowledge that the remaining wells as outlined in the NJDEP-approved Post Remediation Monitoring Plan (PRMP) were not yet installed because of the long delay in receiving the required wetland and stream encroachment permits from the NJDEP DLUR. The Land Use Regulation Program (LURP) Freshwater Wetlands Statewide General Permit No. 14 (GP-14) and Minor Modification Stream Encroachment Permit (mmSEP) applications were submitted to the DLUR on August 15, 2006 and March 26, 2007, respectively. These permits were finally approved as specified in the letter received on February 29, 2008, from the DLUR, as well as the trout maintenance time restriction waiver from DLUR and the Bureau of Freshwater Fisheries that allowed monitoring well installation between the dates of March 15th and June 15th.

As stated in the 2Q08 RAPR, the remaining monitoring wells specified in the PRMP were installed during the week of April 7, 2008. The new wells were sampled and results included in the 2Q08 RAPR, which was submitted to NJDEP on August 19, 2008. The data contained in the 2Q08 RAPR, which were used to focus preparation of this RIW, can be used to develop some general conclusions that are summarized as follows:

- Concentrations of dissolved-phase COC's continue to decline in the main LNAPL source reduction area (data from MW-28 and MW-30 well clusters), and these COC's are essentially limited in vertical depth to just below the bottom of the slurry monolith (from 0 to 5 feet directly below the bottom of the monolith).

- Neither BTEX nor DEHP were detected in any of the ditch surface water samples during the second 2008 quarterly monitoring event, although low levels of DEHP has been occasionally detected in previous surface water samples from the ditch receptor.

- Potential remaining source material occurs within a portion of the wetland area, and along the western edges of the ditch.

This RIW takes into account these conclusions, and focuses on the remaining potential sources present in the wetland area and along the receptor portion of the ditch. Focusing our efforts as described more fully below will result in development of a follow-up remediation solution that will prevent potential future discharge of COC's into the river and ditch receptors.

NJDEPs detailed explanation within the NOD followed by LEC responses are provided as follows:

<u>NJDEP Detailed Explanation # 1.)</u> 7:26E-4.4 (h) 3vii: Failure to properly evaluate any surface water body potentially impacted by contaminated groundwater.

Table 5. Although not stated, LE Carpenter appears to have applied New Jersey Surface Water Quality Criteria for **FW-2** surface water for its assessment of ground water impacts to the Rockaway River. This is incorrect. The correct classification is **FW-2-NT(C1)**. This classification applies to the Rockaway River from the point of discharge of Washington Forge Pond to the Route 46 Bridge. The **C1** classification prohibits any detectable site related contamination in surface waters above background due to ground water or other discharge. The River sampling results indicate a xylene "J" value of 1.1 ppb at sampling point **SW-R1**. The 3rd Quarter 2006 River sampling results indicated a di-(2-ethylhexl) phthalate (DEHP) "J" Value of 2.00 ppb at sampling point **SW-R3**. "J" values have also been reported for site related contaminates at other River sampling points for recent sampling events.

LEC must implement measures to prevent discharge of site related contaminants to the Rockaway River above background. For all subsequent sampling rounds, New Jersey Surface Water Quality Criteria classification C-1 shall apply to the sampling results for the River and ditch discharge to the River sampling points **DRC-2** and **SW-D5.**

<u>LEC Response:</u>

As outlined in N.J.A.C. 7:9B [Surface Water Quality Standards], that portion of the Rockaway River directly south and downstream of the LEC site is classified as FW2-TM(C1) [(Dover) Washington Forge Pond outlet downstream to Rt. 46 bridge]. LEC agrees that the Category 1 [C1] classification implements the anti-degradation policies set forth at N.J.A.C. 7:9B-1.5(d), for "protection from measurable changes in water quality characteristics because of their clarity, color, scenic setting, and other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources." Specifically, this portion of the Rockaway River is classified as a C1 water body based on the FW2 trout maintenance [TM] designation as an exceptional fisheries resource. In accordance with N.J.A.C. 7:9B-1.5 (d) 6iii "Category One Waters shall be protected from any measurable changes (including calculable or predicted changes) to the existing water quality. Water quality characteristics that are generally worse than the water quality criteria, <u>except as due to natural conditions</u>, shall be improved to maintain or provide for the designated uses where this can be accomplished without adverse impacts on organisms, communities or ecosystems of concern."

LEC understands that application of FW2 Surface Water Quality Criteria for Toxic Substances is incorrect and that natural or background concentrations apply. In the case of the LEC site, the upstream Washington Forge Pond SW-R5 surface water monitoring location would be considered background. Any future remedy that is an outgrowth from implementation of this RIW will take this issue into account in order to prevent discharge of site related contaminants to the Rockaway River above background concentrations. In addition, future River and ditch discharge surface water sample results will be compared to applicable background concentrations.

NJDEP Detailed Explanation #2.) 7:26-6.3(a): Failure to contain or stabilize contaminants as a first priority, or to prevent contaminant exposure to receptors and to prevent further movement of contaminants through any pathway.

Sampling results for new replacement well MW-30s (for MW-2) indicate significantly higher contaminant levels after source removal than before in old well MW-2. This contamination is likely discharging into the ditch, as indicated by the surface water sampling results. As stated on page 4-1, *"These data show that residual groundwater contamination remaining in the source reduction area is migrating into the drainage ditch, which is expected given the direction of groundwater seepage flow shown on Figure 5."*

The Department requires LE Carpenter to institute measures to prevent further discharge of ground water contamination into the ditch and Rockaway River. In order for LEC to determine the appropriate remedial measures, it shall submit a remedial investigation workplan that delineates groundwater contamination in the vicinity of MW-30S. In addition, an investigation must be conducted to identify the contaminated source(s) areas that are degrading surface water quality in the ditch and the Rockaway River.

LEC Response:

It is important to note that as a result of the source reduction, no LNAPL free product has been observed within the main excavation area (MW-28 wells) and downgradient of that area (MW-30 wells). In addition, data from the deeper wells at the MW-28 and MW-30 well cluster locations indicate that the residual dissolved groundwater concentrations are limited to only the first five feet below the slurry monolith, whereas the groundwater below this depth is clean. These results are the intended outcome of the source reduction as specified in the NJDEP-approved April 2004 Remedial Action Work Plan for Source Reduction (RAWP). Specifically, the source reduction was designed to remove "as much residual xylene, ethylbenzene and DEHP in the soil (saturated and unsaturated) as is practicable." and ***results to date verify the success of the source reduction remediation***.

NJDEP stated that concentrations at monitoring well MW-30s indicate significantly higher constituent of concern (COC) concentrations after the source reduction remedy than in MW-2(R) prior to the source reduction remedy. Figures 2 and 3 present the time-concentration graphs for DEHP and total xylenes at both of these wells. The time frame for the source reduction remedy is also shown on these graphs. It is important to note that comparability of data from MW-30s to data from MW-2(R) is limited because MW-2(R) was only sampled two times, and therefore may not be representative of natural seasonal variability within the aquifer at that location during the pre-source reduction periods of time.

Concentrations of DEHP, a primary COC at the site, at MW-2(R) prior to the source removal (15,000 µg/L) are slightly lower than the maximum DEHP measured after the source removal at MW-30s (19,000 µg/L on September 13, 2005). More importantly, however, the DEHP concentration in MW-30s has declined from this peak to concentrations less than 4,000 µg/L, with 9.6 µg/L in the latest sampling round on May 8, 2008. ***As graphically reproduced on Figure 2, this represents a strong downward concentration trend as a direct result of the 2005 source removal, in contrast to the NJDEP suggestion that contaminant concentrations have increased.***

Total xylenes did increase prior to the source removal in 2004 at MW-2(R) (49 µg/L on June 18, 2004 and 26 µg/L on August 13, 2004) to the results at MW-30s after the source removal (460 µg/L in former MW-2(R) to 3,900 µg/L in MW-30s). However, total xylenes are shown to be declining following the initial sample at MW-30S (3,900 µg/L on June 21, 2006) through the most recent sampling (460 µg/L on May 8, 2008). The last four of the eight quarterly samples collected from MW-30S have been below the NJDEP groundwater standard for total xylenes (1,000 µg/L). The explanation for the increase from MW-2(R) to MW-30s may simply be that this represents the typical variability within the groundwater in the vicinity of the former source area. However, the more important observation is that ***following the source removal the xylene concentrations continue to decline below the NJDEP standard and has been consistently below the standard for the last four quarters***.

The 2004 RAWP also specified that upon performance of post-remediation monitoring, the results would be outlined in a Focused Feasibility Study (FFS) recommending MNA as a viable alternative to pump and treat (the current ROD remedy) for shallow groundwater. However, residual groundwater contamination, both as pointed out by NJDEP and as discussed in more detail below, show that the predominant remaining issue related to migration of COCs into the ditch and the river is associated with potential residual COC source zones located along the outer edges of the 2005 source

reduction excavation. Implementation of additional remediation as a follow-up to the source reduction within this area will prevent the potential future discharges into the nearby surface water features.

Therefore, this RIW has been prepared to address the post-remediation monitoring results as well as comply with the requirements detailed in the July 19 NOD. Implementation of this RIW will provide data that will be used to develop a remedial action program that when implemented will satisfy the remedial action objectives.

1.2 Objectives

The primary objective of this RIW is to collect sufficient data to determine the appropriate remedial measure(s) that when implemented will prevent potential future discharge of site related contaminants to the Rockaway River and the ditch. Data collected during implementation of this RIW, and presented in a Remedial Investigation Report, will be used to perform a subsequent Focused Feasibility Study (FFS) to select a remedial action that will suffice to replace the current ROD alternative for addressing residual COC's dissolved in groundwater, and that is acceptable to both NJDEP and USEPA.

Data collection objectives at the site, to achieve this primary objective, are to:

- Further characterize and delineate dissolved-phase COCs in groundwater in the vicinity of MW-30S;
- Identify potential, residual source(s) areas of COCs that could result in discharges to the ditch or the Rockaway River;
- Characterize the rate and cause of concentration declines observed in most of the wells on the site;
- Identify potential limitations to the rate of continued concentration declines;
- Determine the time frame in which a no further action, MNA alternative would achieve the remedial action objectives;
- Collect sufficient information to support design of a remedial approach and preparation of a Focused Feasibility Study for addressing groundwater discharge to the ditch and/or the Rockaway River.

These data collection objectives are based on:

- Historical investigations as summarized in Section 3 of this RIW.
- Previously implemented remedial actions. The source reduction remedial action is summarized in Section 3 of this RIW.
- Existing site conditions as summarized in Section 4 of this RIW.

- The Potential Remaining Source Areas of Concern, as described in Section 5 of this RIW.

1.3 Schedule

A proposed RIW implementation schedule is presented on Figure 4.

Section 2
Roles and Responsibilities

A brief summary of the responsibilities of the project team members is included in this section. The RIW project will be completed by RMT, Inc. of Grand Rapids, Michigan. A comprehensive Project Contact List is presented as **Table 1.**

Section 3
Historical Information

3.1 Remedial Investigation (RI)/Feasibility Study (FS) and the 1994 Record of Decision (ROD)

The initial environmental investigations at the site were performed in response to sampling activities performed by the NJDEP in 1980 and 1981. These activities resulted in LEC entering into an Administrative Consent Order (ACO) in 1982. The site was added to the National Priorities List (Superfund) in 1985. The 1982 ACO was superseded by an ACO in 1986, which required LEC to initiate the remedial investigation and a feasibility study (RI/FS) process.

RI/FS investigations were performed on behalf of LEC by Roy F. Weston, Inc. (WESTON) and Geo-Engineering from 1986 to 1992. In April 1994 NJDEP issued a Superfund ROD for the LEC site. The ROD summarizes the results of the RI/FS, the baseline risk assessment, and outlined feasible remedial alternatives. The selected remedy for the site was termed "**Ground Water Treatment with Re-infiltration /Soil Bioremediation – ROD Alternative No. 4**" and included the following components:

1. Floating product/groundwater extraction system installation and operation
2. Remediation via biological treatment of extracted ground water
3. Excavation and consolidation of bis (2-ethlyhexyl) phthalate (another name for DEHP) contaminated soils into a soil treatment zone
4. Re-infiltration of a portion of treated groundwater (with added oxygen and nutrients) into the unsaturated soil treatment zone via perforated piping to allow *in situ* bioremediation of contaminated soils
5. Recirculation of a larger portion of the treated groundwater within the capture zone.
6. Remaining treated ground water to be discharged into a deeper aquifer in accordance with groundwater discharge criteria
7. Provide vegetative soil cover for the area of the groundwater infiltration system
8. Spot excavation and disposal of soils containing Polychlorinated biphenols (PCBs), lead and antimony, where levels exceed the soil cleanup levels in locations other than the east soils area designated as the disposal area
9. Excavation of disposal area sludges/fill, which may inhibit *in situ* treatment
10. Environmental use restrictions on property

3.2 Initial Identification of On-Site Impacted-Soil Areas

As outlined in the document entitled *Workplan for Phase I ROD Implementation* (Roy F. Weston, October 1994), a total of eleven (11) "Hot Spots," were identified during the RI/FS process as areas exhibiting either inorganic or organic contaminant concentrations in soil in excess of ROD cleanup criteria. Of the 11 hot spots identified in the RI/FS, eight (8) were located on the eastern half of the site (east of the rails-to-trails path). Four of these [Hot Spots B, C, D, and E or "the waste disposal area" (WDA)] were identified as hotspots associated with inorganic impacted soils. Hot Spots 3, 4, 5 and 6 were associated with soils impacted by organic compounds. As outlined in Table 1-1 of the report entitled *Quarterly Monitoring Report – L. E. Carpenter Site* (Roy F. Weston, April 1995), Hot Spots D, E, 3, 5, and 6 were excavated and closed as part of Phase I Remedial Actions.

3.2.1 Inorganic Hot Spots B & C

RMT outlined a scope of work in the document entitled *Revised Workplan for Delineating and Characterizing Elevated Lead Concentrations in Soil* (RMT, May 2001). The scope of work outlined in this workplan was specifically designed to (1) fully delineate the horizontal and vertical extent of lead concentrations in the soil and groundwater, (2) determine the potential source(s) of the elevated on-site lead concentrations, and (3) provide data necessary to fill data-gaps that may exist in the WESTON human health risk assessment. This scope of work was approved by NJDEP and USEPA in the NJDEP letter dated August 23, 2001, and subsequently implemented on-site between November 5 and 14, 2001. The results of this investigation were outlined in the document entitled *Nature and Extent of Lead in Soils and Groundwater - Volumes I & II* (RMT, March 2002).

The results of the November 2001 investigation showed that site wide elevated lead concentrations are predominantly a result of historical manufacturing operations, and that lead occurred in two major forms within two distinct types of fill material:

- Lead associated with light- to brightly-colored process waste is likely from a release of potential vinyl stabilizer compounds such as lead phthalate or lead stearate (Ref. Section 3.2.2).
- Lead associated with dark-colored forging and mining era fill material is likely from a release of potential vinyl pigmenting compounds, such as lead chromate.

The on-site lead soils that were found to exhibit a concentration of 400 mg/kg (the USEPA residential remedial action goal) or greater were excavated and disposed of off-site as part of the source reduction activities that took place in the first half of 2005 [Ref. to Section 4.1 of the Remedial Action Report (RAR)].

3.2.2 Organic Hot Spot 4

Process waste associated with historical operations conducted in former Building 14 was identified during the November 2001 lead investigation (Ref. Section 3.2.1). The location and extent of the process waste as shown on Figure 12 of the report entitled *Findings and Recommendations Regarding a Conceptual Free-Product Remediation Strategy* (RMT, March 2002) encompasses historic Hot Spot 4. In addition, the discovery of the process waste material at the GPC-15 sample location detailed in the report entitled *Hot Spot B and Hot Spot C Subsurface Lead Investigation* (RMT, August 1999) geographically correlates with the historic Hot Spot 4 location and the location of process waste discovered during the 2001 investigations.

Even though Hot Spot 4 was originally classified in the RI/FS as an organic hot spot, the process waste located in this area on site contains both organic and inorganic constituents. These materials, process waste and surrounding soils were excavated and disposed of off-site as hazardous waste as part of the source reduction project. The excavation and off-site disposal of this material is outlined in Section 4.2 of the Remedial Action Report (RAR).

3.3 2005 Source Reduction

Successful execution of the remedial design outlined in the April 2004 RAWP required the completion of numerous site preparation tasks prior to the initiation of soil excavation activities:

- Numerous monitoring wells, well points, and free product wells (RAWP Table 7) were abandoned in accordance with N.J.A.C. 7:9D-3.1(g)(2) between the dates of November 29 and December 9, 2004. These activities and associated well abandonment forms were documented in the report entitled *Quarterly Monitoring Report – 1st Quarter 2005* (RMT, March 2005).
- Vertical delineation of smear zone [AEC C-1] activities took place in November and December 2004 and was documented in the report entitled *Pre-Construction Boring Report* (RMT, January 2005).
- Two existing out-building structures identified as treatment buildings used to house the former pneumatic free product extraction system operated by Roy F. Weston (Weston) until 1996 were demolished, site security measures were implemented, and temporary erosion control measures were installed.

The source reduction remedial action took place between January 1, 2005 and June 30, 2005. During this time, the various areas of environmental concern (AEC) identified in the 2004 RAWP were remedied. The remediation goals for the source reduction included the removal of:

- all soils impacted by lead with concentrations greater than 400 ppm

- all process-waste impacted soils with concentrations greater than 400 ppm lead and 600 ppm copper
- all PCB-impacted soils with concentrations greater than 2 ppm, and
- as much residual xylene, ethylbenzene and DEHP in the soil (saturated and unsaturated) as was practicable

On-site remedial construction activities sequentially removed and managed each AEC based on differing levels of contaminant impact, waste disposal classification, and superposition of the various layers or contaminated zones. These data were derived from the results of previous lead and free-product investigations, the results of the December 2004 preconstruction boring activities, and the results of the November and December 2004 PCB delineation activities.

AEC removal sequencing was limited by the superposition of the various layers or contaminated zones. Each AEC was remediated following the general removal hierarchy outlined below:

1. Lead Impacted Soils – AECs A-1, A-2 and A-3 [January and February 2005]
2. Process Waste Areas – AECs B-1 and B-2 [February and March 2005]
3. PCB Impacted Soils – AEC PA [March and April 2005]
4. Clean Soils – [February and March 2005]
5. Smear Zone Soils – AEC C-1 [March, April, and May 2005]

The AEC remedial actions are described in greater detail in Section 8 of the RAWP.

3.4 Remedial Action Report and Explanation of Significant Difference

Following implementation of the Source Reduction remediation in 2005, a RAR was prepared and submitted to NJDEP and EPA on November 18, 2005. The RAR was reviewed and approved by EPA and NJDEP on September 14, 2007 (Appendix B).

An Explanation of Significant Difference (ESD) was granted for all of the "hot spot" soils on site, including soils contaminated with lead, PCB's, process waste, and LNAPL free-product within the smear-zone associated with the groundwater table. The exceptions listed in the ESD included the MW-19 area, and the component of the ROD which relates to the groundwater portion of the initial ROD remedy. The MW-19 AOC is located in the NW corner of the site property and is not relevant to this RIW because it is currently being addressed as outlined in the September 2007 Remedial Action Selection Report (RASR). The groundwater portion of the initial ROD remedy is addressed in this RIW.

The ESD was attached to EPA's letter to NJDEP dated October 24, 2007 (Appendix B). ESD modifications to the selected remedy are as follows:

1. Floating product and associated smear zone soils were excavated and disposed of off-site as an alternative to the active removal system selected in the ROD due to the low yield of floating product extraction system previously installed;
2. Bis (2-ethlyhexyl) phthalate (DEHP) impacted soils were excavated and disposed of off-site instead of being consolidated in to a soil treatment zone;
3. No re-infiltration of treated groundwater will be performed for the purpose of treating soil contamination, as all contaminated site soils were excavated to meet cleanup standards and disposed of off-site;
4. Following implementation of the source reduction remediation, all disturbed areas were restored to proposed final grades with a vegetative soil cover. The ROD selected a vegetative cover over the area of groundwater infiltration;
5. Excavation and off-site disposal of soils containing PCBs and lead were completed to meet the more stringent New Jersey Residential Direct Contact Soil Cleanup Criteria (RDCSCC) (0.39 ppm and 400 ppm, respectively) instead of the Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (2.0 ppm and 600 ppm, respectively) as required in the ROD;
6. All soils above site-established cleanup levels were excavated and disposed of off-site during the source reduction remediation, instead of the excavation of some soils and on-site treatment through flushing of other soils as selected in the ROD;
7. Environmental use restrictions on the property as selected in the ROD are no longer needed since RDCSCC were met for PCBs and lead at the site.
8. It should be noted that while most of the site soils were excavated to levels below the water table, thereby removing all contaminates, there is a limited area of soils in the southwest corner of the site, called the B-2 area, where soils were excavated to a depth of 2 feet and the excavation was then backfilled with clean fill. Two post-excavation samples collected at the base of this excavation in this area exceeded the NJDEP residential soils cleanup goal for antimony of 14 ppm. The concentrations of antimony collected at the base of the excavation are well below the NJDEP non-residential cleanup goal, and are covered with two feet of clean soil. Based on a review of all post-excavation samples of this limited area, EPA and NJDEP have determined that the concentrations of antimony detected during post-excavation sampling event do not warrant environmental use restrictions on the property. A detailed evaluation of this issue is available for review in the site files.
9. Also, it should be noted that this ESD does not address any changes to component 2 of the ROD which relates to the groundwater portion of the remedy. Therefore, this ESD does not address any changes to the groundwater pump and treat system as required by the ROD, The purpose of the pump and treat system as is to address the residual groundwater contamination after the floating product areas have been remediated. The pump and treat

component of the remedy is currently being reevaluated. NJDEP and USEPA review of the groundwater data indicate the potential for Monitored Natural Attenuation (MNA) to be an appropriate groundwater remedy for a portion of the groundwater contamination. In January 2005, LEC began to implement an MNA work plan to collect the required data to determine if MNA will be an effective remedy for this site. NJDEP and EPA will evaluate the results of this ongoing MNA investigation and will determine, in the future, if MNA is the appropriate remedy for this site. In addition, further investigations are ongoing to further evaluate an area of benzene, toluene, ethylbenzene and xylene (BTEX) contamination within the MW-19 area. [NOTE: Although natural attenuation of BTEX constituents has been shown to be strong around the periphery of a stable dissolved phase plume that is not migrating off-site, residual source material was discovered to still exist under the northwestern corner of Building 9, which could provide contaminant mass for this small area for many years to come. Therefore, an alternate accelerated remedy has been proposed in the September 2007 RASR for this area].

3.5 Post Remedial Routine Monitoring Program (PRMP)

3.5.1 PRMP Implementation

Discussions were initiated by LEC and RMT with both NJDEP and USEPA during the fourth quarter of 2005 (4Q05) regarding the development and installation of the post source reduction site monitoring network in accordance with the submitted PRMP. A formal regulatory review and comment letter regarding the PRMP was received by LEC on February 22, 2006. RMT prepared a response to the February 22, 2006 NJDEP comments in Section 1 of the 1Q06 RAPR dated May 9, 2006. NJDEP approved the 1Q06 RAPR including response to the PRMP comments in their letter dated March 30, 2007.

RMT, on behalf of LEC, began installing the PRMP monitoring well network within the source area on June 5, 2006. RMT and LEC submitted the necessary GP-14 permit application to the NJDEP DLUR on August 14, 2006 requesting authorization to install the remaining five monitoring wells (*i.e.*, monitoring devices) in the wetland area located east of the site (Wharton Enterprise property). In February 2007, RMT was notified during follow up conversations regarding approval of the GP-14 application that a modification to the existing Stream Encroachment Permit (1439-04-0001.1 FHA040001 SEP) would be required in order to allow the placement of fill material in the 100-year floodplain. This fill material is required because the remaining five monitoring wells had to be installed through mounds to facilitate screening the shallow water table with a properly constructed well. RMT submitted the requested SEP modification to NJDEP DLUR on March 26, 2007 to avoid further delays.

The GP-14 permit/SEP modification permits were received March 31, 2008. RMT, on behalf of LEC, formally requested a waiver from the requirements of ***GP-14 Permit Special Condition No. 1 – Prohibition of construction activities between the dates of March 15 and June 15 to protect the trout stocked water of the Rockaway River*** in a letter dated March 18, 2008. Specifically, RMT requested approval to install, construct, and restore the five (5) mounded groundwater monitoring wells as described in the GP-14 permit application dated August 15, 2006 [Revised March 22, 2007 and last revised September 7, 2007] during the week of April 7, 2008. RMT received approval of the waiver in an email from the Bureau of Freshwater Fisheries dated March 25, 2008. Therefore, on April 6, 2008, RMT mobilized to the LEC site to complete the PRMP well network installations. Details of the monitoring well installations and well details can be found in Section 3 of the 2Q08 Remedial Action Progress Report (RAPR).

3.5.2 Routine Monitoring

The 2Q08 monitoring event marks the first time that all of the wells specified in the PRMP have been sampled. The 2Q08 sampling event is the ninth event for the source area monitoring wells installed in June 2006. This period of time since sampling and testing the 2006 wells began was a result of the more than two year period of time it took for the New Jersey DLUR to approve the GP-14 and Stream Encroachment Permit applications.

As outlined in the PRMP, the following monitoring activities are conducted on a quarterly basis:

- Static water level measurements are collected from thirty-nine (39) groundwater monitoring well locations and twelve (12) surface water (Rockaway River and drainage ditch) locations using an electronic water level indicator.
- Grab samples are collected from the five (5) drainage ditch and seven (7) Rockaway River surface water sample locations. Surface water samples are analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and DEHP only.
- Low flow sampling is conducted at twenty (20) monitoring wells. Groundwater samples are analyzed for BTEX, DEHP, and MNA parameters (*field*: DO, pH, ORP, conductivity, turbidity, temperature, ferrous iron, alkalinity, and carbon dioxide; *laboratory*: heterotrophic plate count, TSS, TDS, nitrate nitrogen, ammonia nitrogen, total phosphorus, sulfate, methane and dissolved lead).
- Analytical data tables (*e.g.*, field and lab data), a site wide potentiometric surface drawing, various trend charts and drawings are generated as required based on data received throughout the years of monitoring. In addition, text describing procedures, methods, results and recommendations for each sampling event are also generated.

Quarterly monitoring reports (including a HAZSITE electronic data diskette for submittal to NJDEP) are prepared and submitted, as required by the 1986 ACO to both NJDEP and USEPA, on or before the last day of the month following the reportable quarter (*i.e.,* 1Q08 = April 30, 2008).

Section 4
Site Setting

4.1 Soils and Topography

The Pre and Post source removal site topography are depicted on Figures 5 and 6, respectively. Figure 7 is the existing site conditions map, showing all existing groundwater monitoring wells, surface water staff gauges, ground topography, and other site features. In general, the LEC property is flat to gently sloping. The LEC property is topographically split by the former railroad track bed, currently a recreational trail. Surface drainage on the northwestern side of the trail is to the northeast into the low area around the MW-18 well cluster. Surface drainage on the southeastern side of the recreational trail is predominantly eastwards towards the drainage ditch, but is southwards towards the Rockaway River on the 60-100 foot wide strip along the river.

The distribution of surficial soils at and surrounding the site is shown on Figure 8. Note that a transition into finer-grained soils (Whitman very stony loam) occurs directly east of the former LEC Building 14 and RR spur and can be seen on the section of the USDA soils map reproduced on Figure 8. A detailed summary of soil types found at the LEC facility and their characteristics can be found in Section 2.3 of the RAWP.

4.2 Site Geology

The regional and local geology is detailed in the 2004 RAWP, the March 28, 2003 Abandoned Mines Evaluation report, and in the Weston September 1992 *Final Supplemental Remedial Investigation Addendum for L.E. Carpenter and Company*. This section summarizes geologic information from those reports, as well as from other available sources. This summary focuses on those aspects most critical to the remedial investigation project contained in this RIW.

The LEC site is located in the Dover Quadrangle, within the Highlands Physiographic province. Bedrock in this area consists mainly of Precambrian age metamorphic and igneous rocks arranged in northeastward trending ridges separated by valleys that range between 200-300 feet below the ridge crests. These rocks have been mapped by Sims, Davidson, and Koch (1949), and a portion of their map in the immediate vicinity of the LEC site is reproduced on Figure 8.

The bedrock formations host extensive magnetite deposits that comprise one of the oldest mining regions in the United States (the Dover mining district). The iron ore deposits are denoted on Figure 8 as northeast-trending solid and dashed red lines. These lines represent the strike of the somewhat tabular lathe-shaped ore bodies, or the interception of the ore bodies

with the earth's surface. The ore bodies, along with their host rocks, dip approximately 40+ degrees southeast.

The bedrock deposits are covered by variable thicknesses of unconsolidated soils from glacial (deposited directly by former ice sheets) and alluvial (deposited by glacial melt-waters and post-glacial streams) processes. These deposits have been mapped by Stanford (1989) on the scale of the Wharton 7.5-minute quadrangle (1-inch = 2,000 feet) and part of that map is reproduced herein on Figure 8.

Regionally, Wharton is located near the southernmost extent of the most recent Wisconsinan glaciation event, within a terminal moraine (see inset on Figure 8 labeled "Maximum Extent of Wisconsinan Glaciation"). A terminal moraine is composed of glacial till (a heterogeneous mixture of clay, silt, sand, and gravel) deposited directly from glacial ice at the terminus of the glacier, or various proportions of till and stratified drift. Stratified drift included in terminal moraines would be deposited in ephemeral ponds and puddles between glacier and moraine or within small basins within the moraine itself, and as fans and stream channel fillings mainly on the distal slope of the moraine.

Following the retreat of the Wisconsinan ice-sheet, the ancestral Rockaway River formed as glacial melt-waters drained away from glacial lakes, as shown on the inset in Figure 8. The terminal moraine till deposits shown on the surficial geology map on Figure 8 are colored in bright green (symbol Qlwtm); these deposits are closely associated with the lodgment (basal glacial) till colored in the lighter green color (symbol Qlwt). Two other deposit types mapped on the regional surficial geologic map that are relevant to the LEC site are Rockaway River outwash gravels and more recent post-glacial alluvium consisting of silt and fine sand with minor clay and pebble to cobble gravel.

The processes described above are responsible for the naturally occurring deposits found at the LEC site. Near-surface soils at the LEC site range from artificial fill covering Rockaway River outwash sand and gravel on approximately the western half of the site, and deposits that appear to range from finer-grained post-glacial alluvium and/or till along the eastern half of the area.

4.3 Site Hydrogeology

The hydrogeologic conditions of the site have been presented in the 1990 *Report of Revised Investigation Findings, L.E. Carpenter & Company*, by GeoEngineering, Inc., and in the 1992 Weston report entitled *Final Supplemental Remedial Investigation Addendum for L.E. Carpenter and Company*. More recent data collected after the source removal in 2005 includes well clusters MW-28 through MW-35. Boring logs for these wells are included in Appendix C, with water

level data in Table 2. Groundwater testing results are included in Table 3 (BTEX and DEHP), Table 4 (MNA laboratory analytical data), and Table 5 (field MNA parameters). Surface water quality data are included in Table 6.

Figures 9 and 10 show conceptual cross sections of current geologic conditions at the site, along east-west and north-south transects respectively. The cross sections take into account all historical data and extend through the new PRMP downgradient monitoring locations in the wetland area. In the western portion of the site, the upper stratum is composed largely of sand and gravel outwash, overlain by a thin layer of fill. In the eastern portion of the site, this outwash unit is overlain by relatively low-permeability silt and clay that occurs within the upper 5 to 10 feet, based on the 1992 Weston *Supplemental Remedial Investigation* Report. Presumably these finer-grained deposits mostly represent alluvium from the Rockaway River, although some may also be a result of post-depositional melting of outwash-entrained blocks of glacial ice. However, later borings for Enhanced Fluid Recovery (EFR) wells and recent exploratory trenching identified a significant amount of sand and gravel in the upper alluvial unit at a number of locations within the free product zone that were previously identified as being silt alluvium. In addition, it now appears that the upper alluvial unit is thinner than previously thought, is quite variable laterally, and includes areas of silty sand as well as silt and clay. The upper alluvial unit of silt, sand, and clay overlies deeper permeable units (up to 170 feet total in thickness) composed of stratified drift of sand and gravel deposits originating from glacial-melt outwash.

The shallow sediments that occur just beneath the surface on the western portion of the site have a hydraulic conductivity of approximately 37 feet/day (Weston, 1992a). The hydraulic conductivity of the upper stratum of silt and clay alluvium that occurs in the eastern portion of the site has not been measured, but is likely on the order of 1 foot/day or less, based on geologic log descriptions. The horizontal hydraulic gradient varies across the site, but it averages approximately 0.0016 ft/ft, based on examination of equipotential maps from GeoEngineering (1990), Weston (1992a), and RMT (2003). Assuming a typical effective porosity of 0.3 (Freeze and Cherry, 1979), the horizontal groundwater seepage velocity is approximately 73 ft/year in the shallow portion of the outwash sand.

Shallow groundwater flow is substantially affected by adjacent surface water bodies. The site-wide shallow water table map (Figure 11) is based on data included in Table 2**.** This map indicates that groundwater flow direction in the shallow aquifer east of the recreational trail (the former rail spur) is generally toward the east. Washington Forge Pond acts as a constant head boundary that provides the driving head for both shallow and deep groundwater flow. As a result, areas of the site exhibit upward vertical gradients, while the drainage ditch acts as a discharge zone, as does the downstream portion of the Rockaway River. The portion of the

Rockaway River south of and immediately adjacent to the site is often a losing reach, particularly in drought periods when the groundwater levels beneath the site are depressed a few feet and a gradient from the river into the site occurs. As one moves downstream the River oscillates between losing and gaining and the flow regime is often difficult to define.

Shallow groundwater flow is also affected by the presence of the drainage ditch. The drainage ditch acts as a local groundwater "sink," and shallow groundwater flow from a large portion of the site is controlled by the drainage ditch.

The regional groundwater "sink" for this area is the Rockaway River, and it is this feature that causes the strong upward vertical gradients observed for all of the on-site well clusters. Historical water level data for this site confirms the predominant upward vertical gradients across the site.

Historically, shallow groundwater at the southern edge of the LEC site often appears to be recharged directly by the Rockaway River and flows towards the site before turning eastward toward the drainage ditch and the narrow area between the former Air Products property and the Rockaway River known as the Wharton Enterprise property. At other times, flow at the southern edge of the site appears to head east-northeast parallel to the Rockaway River. Shallow groundwater on the Air Products property flows southeast, south, and southwest towards the drainage ditch.

4.4 Groundwater Quality

The well clusters within the central (MW-28 cluster) and downgradient (MW-30 cluster) portions of the source reduction area have 3 wells. The shallow well screens (s wells) are directly below the slurry monolith floor at 10 to 15 ft bgs. The intermediate monitoring wells (wells labeled with an "i") were screened in approximately the next 5 feet below the bottom of the shallow well screen at 15 to 20 ft bgs.

In 2Q08, low levels of dissolved COCs continue to be found in groundwater in the source reduction area interior monitoring wells MW-28s and MW-28i (see Figure 12 and summary of organic results in Table 3). The concentrations of dissolved benzene, ethylbenzene, and xylene appear to be generally decreasing over time in the MW-28 well cluster. In fact, no BTEX constituents are present at levels that exceed current New Jersey Groundwater Quality Standards (NJGWQS). Dissolved DEHP increased at MW-28s during 2Q08, but the overall trend is a decrease in DEHP concentration.

Site COCs also continue to be found dissolved in groundwater from source reduction area downgradient well MW-30s (Figure 12). However, for the past five events, no detectable COCs have been present in samples from wells MW-30i and MW-30d. This indicates that the vertical

extent of site COCs in the vicinity of the MW-30 cluster is limited to only the top five feet or less of the aquifer immediately below the slurry monolith. In addition, DEHP and BTEX concentrations are fluctuating in monitoring well MW-30s, but overall concentrations are generally decreasing (Figures 2 and 3**,** respectively). Some of the fluctuations show DEHP concentrations above the saturation limit for that constituent. Delineation of the COCs in groundwater in the vicinity of MW-30s is one of the objectives of this RIW.

During 2Q08, groundwater samples collected from all of the wetland area wells, with the exception of MW-34s, had concentrations of DEHP above the higher of the Class IIA NJGWQS and Practical Quantitation Limit (PQL). Groundwater samples collected from MW-31s and MW-32s also contained concentrations of ethylbenzene and total xylenes significantly above the higher of the Class IIA NJGWQS and PQL. In addition, free product was measured in MW-32s. Low concentrations of COCs were found in shallow monitoring wells MW-33s, MW-34s, and MW-35s.

MNA parameters for groundwater are presented in Table 4 (analytical data) and Table 5 (field parameters). These data indicate that the groundwater is strongly anaerobic downgradient of the source removal area as shown by low dissolved oxygen (*e.g.*, DO<1 mg/L[1]), negative redox, high ferrous iron concentrations (*e.g.*, >1 mg/L[1]), non-detectable nitrate and measurable ammonia-nitrogen, low sulfate concentrations (*e.g.*, <0.5 mg/L[1]), and the presence of significant methane concentrations (*e.g.*, >500 µg/L[1]). Well MW-25R indicates somewhat less reducing conditions in that the methane concentrations are typically less than 100 µg/L, measurable sulfate and occasionally lower iron concentrations and measurable DO. Redox sensitive parameters at upgradient well MW-27s indicates that, at times, the groundwater is aerobic (*i.e.*, high DO, low iron, "background" sulfate, *etc.*); however, at other times the upgradient groundwater still has indications of being somewhat reducing.

4.5 Surface Water Quality

4.5.1 Eastern Drainage Channel

As part of the quarterly monitoring events, five (5) points within the eastern drainage channel that separates the adjacent Air Products facility from the LEC site and the adjacent Wharton Enterprises property are sampled for surface water quality (see location on Figure 8). This sampling is conducted at the request of NJDEP as outlined in their letter dated March 23, 2005.

[1] These criteria for anaerobic water are from EPA, 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water. EPA/600/R-98/128

During the 2Q08 sampling event, locations SW-D-1, SW-D-2, SW-D-3, SW-D-4, and SW-D-5 were sampled. COC's have been detected at low levels sporadically in some of the ditch surface water samples, but the level and frequency of these detections appear to be decreasing over time (Table 6).

4.5.2 Rockaway River

In addition to the drainage channel, seven (7) surface water samples from the Rockaway River are also collected (See locations on Figure 7).

During the 2Q08 sampling event, Rockaway River surface water samples SW-R-2 through SW-R-4, SW-R-6, and Washington Forge Pond surface water sample SW-R-5 had no detectable COCs.

Sample SW-R-1 is collected near the river edge adjacent to the location where product sheen had been previously observed in the river (before the source reduction). As discussed in earlier reports, the sheen was discovered in 2004 as a visible coloration on top of quiescent water pooled within the wetland area. DEHP was not detected in the surface water sample from SW-R-1 in 2Q08. However, the sample did contain very low concentrations of ethylbenzene (1.2 µg/L) and total xylenes (5.9 µg/L). No product sheen was observed at this location during the 2Q08 event.

Another surface water sample is collected in the ditch near its intersection with the Rockaway River approximately 10 feet upstream in the drainage channel (see location on Figure 7). Based on the groundwater contour elevations and aerial extent of surface water (Figure 11), this location represents the principle discharge point from the ditch/beaver pond into the Rockaway River. Similar to the other river samples collected in 2Q08, the "Ditch-River Confluence" sample DRC-2 had no detectable BTEX and DEHP.

4.6 Wetlands

The locations of "National Wetland Inventory" wetlands near the LEC site are shown on Figure 13**.** More detailed delineation of wetlands was performed as part of the 2005 source reduction. A portion of the source reduction action included excavation of soil within the wetland areas located along the drainage ditch on the eastern side of the LEC site, and within the off-site Wharton Enterprise property east of the LEC property line. LEC applied for a Freshwater Wetlands/Open Water Fill Permit General Permit No. 4 ~ Hazardous Site Investigation and Cleanup in accordance with N.J.A.C 7:7A-5.4. Delineation of these wetland areas was facilitated via review of historical Letters of Interpretation [LOI] and on-site surveying performed in March 2004 by a wetlands expert [JFNew]. Authorization to proceed with source reduction

remedial activities within the wetland and transition areas was provided in the *Authorization for Freshwater Wetlands Statewide General Permit No. 4 (File No. 1439-04-0001.1 FWW 040001)* ("the GP-4 permit") dated February 25, 2005. Information specific to these wetland delineation activities is presented in the *Freshwater Wetlands General Permit 4 Application* (RMT and JFNew, October 5, 2004), subsequent response to NJDEP DLUR comments on the GP-4 permit application, and the GP-4 permit itself.

4.7 Land Use, Environmentally Sensitive Areas and Sensitive Human Receptors

Figure 14 shows potential environmental and human receptor sensitive areas within an area defined by a 1,000-foot radius from the area of concern boundary. The area of concern is defined as the LEC site, together with the western portion of the Wharton Enterprises area (encompassing the easternmost extent of dissolved-phase groundwater contamination emanating from the site). Sensitive environmental areas within 1,000 feet of the area of concern include the Rockaway River bordering the site to the south and wetland areas located along the drainage ditch on the eastern side of the LEC site, within the off-site Wharton Enterprise property east of the LEC property line, and various wetlands located within 1,000 ft to the north and west of the site. Human receptors within 1,000 feet of the site include the high density, multiple dwelling residential areas located immediately southwest of the site, and the single unit, medium density residential area located north of the site. The nearest public community water supply well is located outside of the 1,000-foot radius area, approximately 3,000 feet to the west (upgradient) from the site boundary. Additional public community water supply wells are located to the southeast, with the closest being approximately 3,500 feet from the site boundary.

Section 5
Areas of Concern

5.1 General

As described in Section 3 Historical Information, a large source reduction excavation was conducted to remove LNAPL consisting of DEHP and BTEX. The current distribution of these COCs in the vicinity of the former LNAPL smear-zone area is described in Section 4 Site Setting, and the most recent data is summarized on the 2Q08 groundwater quality map shown on Figure 12.

The areas of concern raised by the NJDEP in their June 19, 2008 letter include the potential for discharge of COCs in groundwater to the ditch and the Rockaway River, specifically in the vicinity of well MW-30s, and potential continuing source area(s) in the groundwater that may be affecting surface water.

Potential remaining COC source(s) that may exist are areas that were not excavated during the 2005 source reduction remediation (especially downgradient edges of slurry-excavation adjacent to the river and ditch). These two areas of concern, groundwater and potential remaining source(s), and the data needed to assess these areas are described in the following subsections.

5.2 Potential Remaining Source(s)

Historic releases of liquids at the site resulted in DEHP/BTEX occurring in the soils and groundwater in both free-product LNAPL and dissolved phases. The 2005 source reduction resulted in the removal of 34,000 tons of contaminated smear zone soils with the associated LNAPL contained in these soils. The area of this removal is shown on Figure 7; the depth of the excavation extended below the zone where LNAPL was observed to be present as outlined on the cross sections in Figures 9 and 10.

Potential remaining source(s) would likely include residual isolated pockets of DEHP/BTEX LNAPL that may be present outside the source reduction area. Current observations that indicate potential remaining source(s) are as follows:

- **Direct Observations –** Based on the description of the current site setting (see Section 4), there is one well that has a small thickness of LNAPL observed during the 2nd quarter 2008 (MW-32s 0.10 ft on May 5, 2008). In addition, some evidence of LNAPL as isolated blebs and pre-well installation free product was observed while drilling MW-35s. However, since

installation and development LNAPL has not been detected in that well, although DEHP concentrations in groundwater were detected above the solubility limit.

- **Indirect Observations –** There are several wells that have concentrations of DEHP in excess of its single compound solubility in water (0.285 mg/L @ 24°C [http://www.epa.gov/OGWDW/dwh/t-soc/dehp.html]). Wells with DEHP concentrations that are approximately equal to or in excess of solubility indicate there is probably some residual phase or potentially free phase LNAPL within the area of the well. These wells include: MW-30s (although concentrations have declined below solubility limits in 2Q08), MW-31s, and MW-35s. Wells with DEHP concentrations less than 1% of solubility (2.85 µg/L) indicate that no NAPL probably exists. These wells include MW-25(R), MW-27s, MW-29s, MW-33s, and MW-34s and establish the limit beyond which any residual or free phase NAPL probably does not exist.

Based on these two sets of observations, the two areas that may contain remaining source(s) are shown on Figure 15. These areas include a narrow strip of property located between the source removal area and the ditch and an area east of the source removal area between the ditch and the Rockaway River. The strip of property between the source removal area and the ditch is approximately 10 -15 ft wide and potentially 120 ft long.

The potential source area east of the principle source reduction area is somewhat undefined, but the potential limits of this AOC are also shown on Figure 15. This area extends east from the edge of the source reduction area out to potentially well MW-35s but it does not extend to well MW-25R which was shown to be clean with respect to DEHP and BTEX. This potential source area may extend from the edge of the ditch to an area near the Rockaway River. The absence of LNAPL indications at wells MW-33s and MW-34s indicate a southern limit to the area.

5.3 Groundwater

Section 4 (Site Setting) describes the conditions controlling groundwater flow and the distribution of groundwater quality. As described in this RIW and shown on Figure 11, groundwater flow direction from the main source reduction area is toward the east, including flow-paths towards the ditch, wetland area, and to the Rockaway River.

Groundwater within the remaining potential source zone contains the COCs DEHP and BTEX. These COCs extend from beneath the source removal area to both the ditch (MW-30 well cluster) and the Rockaway River (MW-34s with predominantly xylenes and MW-35s with predominantly DEHP; see Figure 12). Some of this contamination is likely a function of easterly groundwater flow that has transported the COCs eastwards from the source reduction area to an unknown point between wells MW-35s and MW-25(R), but most of it may be a function of potential remaining source within the wetland area. As shown on Figure 12, well MW-25(R)

indicates no detectable COCs, which served to define the eastern-most extent of dissolved-phase LNAPL contamination.

5.4 Ditch

The ditch, located north of the LEC property and shown on each of the figures, is considered a receptor of groundwater contaminant discharge. The groundwater remediation standard included in the June 19, 2008 NJDEP letter is to prevent groundwater discharge of site related contaminants to the ditch. Therefore, the groundwater discharging to the ditch is considered an area of concern for the purposes of characterization in this RIW.

5.5 River

The Rockaway River, located south of the LEC property and shown on each of the figures, is considered a potential receptor of groundwater contaminant discharge. The groundwater remediation standard included in the June 19, 2008 NJDEP letter is to prevent groundwater discharge of site related contaminants to the River. Therefore, the groundwater discharging to the Rockaway River is also considered an area of concern.

Section 6
Sampling and Analysis Plan

6.1 General

Data collection objectives (described above in Section 1.2) are summarized as follows:

- Delineate the constituents of concern (COCs) in groundwater in the vicinity of MW-30s;
- Identify potential, residual source(s) areas of COCs to the ditch or the Rockaway River;
- Characterize the rate and cause of concentration declines observed in most of the wells on the site;
- Identify limitations to the rate of continued concentration declines;
- Determine the time frame in which the MNA and ultimately no further action alternatives would achieve the remedial action objective;
- Collect sufficient information to support a Focused Feasibility Study Report for potential groundwater discharge to the ditch and/or the Rockaway River.

Activities needed to fill these data gaps are outlined on Table 7 and described in the following areas of concern. The Quality Assurance Project Plan (QAPP) and the Health and Safety Plan that will control work conducted as part of this RIW are included in Appendix E and Appendix F respectively.

6.2 Remaining Sources Sampling Plan

The data collection objective for the remaining potential source area is to determine the extent of LNAPL in residual or free phase so as to determine the extent and magnitude of a potential remediation system needed to prevent the potential for COCs to discharge to the ditch or river at concentrations above appropriate standards.

The primary method proposed to be used is a Tar-specific Green Optical Screening Tool (TarGOST®) on the end of a geoprobe at locations shown on Figure 15. This tool is capable of continuous logging the presence of free or residual phase DEHP and xylenes. Results from this tool are presented, in real time, as a continuous geophysical log with the magnitude of the response generally proportional to the NAPL saturation (see Appendix E QAPP for specific examples).

A sample of LNAPL from the LEC site was tested by Dakota Technologies, Inc. on the TarGOST® and the ultra violet optical screening (UVOST) tools. Both the TarGOST® and

UVOST tool are shown to be able to detect the NAPL both in liquid form and when mixed in sand. However, Dakota Technologies experience is that other DEHP NAPL has not been detectable with the UVOST tool. Therefore, to be more conservative, the TarGOST® tool is proposed to be used for characterization of NAPL at the LEC site. LEC anticipates that the TarGOST®/geoprobe technology will work in the field. However, the geoprobe penetration depth may be limited because of the presence of large boulders and rocks within some of the near-surface sediments. Therefore, source characterization at those sampling locations may be augmented by the use of a mini-sonic drill rig that can provide soil-core sections continuously every five feet. These continuous cores will be conventionally logged with soil sampling at each boring as described for the Geoprobe soil sampling, to determine the vertical distribution and nature of any residual LNAPL that is present. In those instances, Oil-N-Soil test kits will be used at regularly-spaced intervals to evaluate the nature of residual NAPL (Appendix E).

The TarGOST® probe has a soil conductivity probe built in. Therefore, in addition to the TarGOST® results, the soil conductivity will be logged. This tool will be useful in distinguishing between fine grained and coarse grained soils.

The TarGOST® probe locations shown on Figure 15 are located beyond the extent of the LNAPL source removal (also shown on Figure 15) in the two areas of potentially remaining sources, between the source removal and the edge of the ditch (TG01 and TG02) and the area downgradient of the source removal where LNAPL migration away from the former source area may have occurred and evidence of potential LNAPL still exists (TG03 through TG10). In addition to the proposed locations shown on Figure 15, it may be necessary to conduct additional "step-out" borings using either the mini-sonic or the TarGOST® technology, if we determine that additional samples are needed to adequately characterize soil COC extent based on the real-time field data. Examples of TarGOST® and Oil-N-Soil outputs are provided in the QAPP (Appendix E).

Representative soil samples will be collected at selected locations for soil analysis by field screening with hydrophobic dye and laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), DEHP, and grain size analyses. These samples will be collected at locations based on the results of the TarGOST® probes and at locations to quantify the potential distribution of LNAPL.

The first TarGOST® probe would be pushed within 15 ft of well MW-32s, where LNAPL has been detected, to determine whether the TarGOST® detects NAPL at that location. After completing this TarGOST® geoprobe, a second soil sampling geoprobe would be pushed to collect soil samples at depths above, at and below the peak of the TarGOST® response. Samples collected below the peak of the TarGOST® response would be collected by pushing a

larger diameter probe and then advancing the smaller soil sampling geoprobe to avoid cross contamination of the lower sample.

Soil samples will be analyzed in the field for the presence of NAPL using an Oil-N-Soil test kit, as described in Section 4 Site Setting and in the QAPP in Appendix E.

A split sample from each location would be collected for potential BTEX and DEHP analysis. Following completion of the geoprobe survey, 9 representative samples will be submitted for analysis and comparison to the Oil-N-Soil and TarGOST® field methods. These representative samples will be selected based on the Oil-N-Soil and TarGOST® results, but will in general, provide:

- A complete profile at 2 geoprobe locations where NAPL is detected by the field methods, to show results above the NAPL, at the peak NAPL concentration, and below the peak. This is a total of 6 samples for analysis.
- One sample from the peak NAPL concentration at each of 3 other TarGOST® geoprobe locations, for a total of 3 samples.

Two representative soil samples from each permeable soil unit (anticipated to be 4 samples) will also be submitted for total chromium and total organic carbon analyses. Field sampling methods and the laboratory analytical methods for the soil BTEX and DEHP analyses are described in the QAPP included in Appendix E.

6.3 Groundwater Sampling and Characterization Plan

Groundwater sampling events will continue on a quarterly basis that will include sampling from the well proposed herein as well as all of the previously installed PRMP wells. In addition, an enhanced biodegradation pilot study will be conducted to assess the potential viability of the use of biodegradation methods to achieve remedial action objectives.

6.3.1 MW-30s Area

Groundwater monitoring well MW-36s will be installed between MW-30s and MW-31s (see location on Figure 15) to delineate the COCs in groundwater in the vicinity of MW-30s. This additional well will characterize the potential width of potential discharge to the ditch of the COCs identified at well MW-30s. Well MW-36s will be constructed in a manner similar to MW-30s, with its screen across the water table, in accordance with N.J.A.C. 7:9D, and by a licensed New Jersey well driller. Continuous split spoon samples will be collected during drilling using ADTM method DI586-84. The depth of the water table is expected to be at a depth of approximately 5 ft,

depending on the ground surface elevation at the final location. Development of the well will be completed by surging and bailing to yield a non-turbid sample, if practicable.

Well MW-36s will be included in one round of the quarterly groundwater sampling program, analyzing for BTEX, DEHP, and MNA parameters using the routine sampling and analytical methods, as described in the QAPP in Appendix E. In addition, TOC will also be analyzed for one round of sampling.

6.3.2 Hydraulic Conductivity Testing

Hydraulic conductivity tests will be conducted on each of the wells located generally downgradient of the source removal area to help in evaluation of remedial action alternatives. These data would be used to help determine the groundwater flow velocity, flux of COCs and potentially in conceptual design and costing of each alternative. The hydraulic conductivity test will be conducted using a bail-down test method, by removing one or more bailers of water from the well and recoding recovery.

6.3.3 Groundwater COCs Biodegradation Pilot Study

A biodegradation pilot study will be conducted to allow for assessment of the potential viability of the use of biodegradation methods to achieve remedial action objectives. The currently available data is inadequate to determine whether biodegradation of the DEHP is a viable option to be considered for either the short term or the long term and under MNA or enhanced biodegradation methods.

The Pilot Study will consist of installation of 3 air sparge wells in a tight cluster, installation of 3 observation wells, and operation/monitoring of the air sparge and observation wells for a period of 3 months. The air sparge wells will be installed in a triangular pattern spaced 25 ft apart to a depth below the observed COCs in excess of the groundwater standard based on surrounding monitoring well nests. This depth is approximately 15 ft below ground based on data from the MW-30 well cluster where MW-30i is typically below detection limits for DEHP and total xylenes.

The pilot study is proposed to be conducted in an area where there is sufficient thickness of saturated, permeable soils to operate an air sparge pilot study *(e.g.,* at least 3 ft). The location is shown on Figure 15 to be adjacent to MW32S. However, a suitable location will be based on a combination of the existing data and results of the TarGOST® and conductivity survey.

One observation well will be installed in the center of the triangle and the other two wells will be spaced 20 ft and 35 ft, respectively, downgradient of the center of the air sparge wells. The well in the center of the air sparge well cluster is intended to see rapid

and intense response from the air sparge wells and will be used early in the pilot study to determine if aeration of the groundwater results in enhancing biodegradation. The downgradient observation wells will be used early in the pilot study to assess the radius of influence of the air sparge system. Wells will be screened across the water table, typically at a depth of approximately 5 ft.

The pilot study will initially be run without addition of nutrients or supplemental bacteria, to determine if aeration alone will promote biodegradation. Give that the groundwater has been in contact with DEHP for several years, it is anticipated that there has been sufficient time and opportunity for an acclimated bacterial population to have been established, although they may not have flourished because of the lack of adequate dissolved oxygen. Based on monitoring results of the pilot study, addition of nutrients (phosphorous and nitrogen) may be necessary as a small quantity of liquid fertilizer or the addition of specialized bacteria available from specialty bacteria supply firms. These decisions will be made after receiving results of monitoring after a period of 1.5 months.

Monitoring will consist of the following:

- Air sparge wells: Air injection rates and pressures on a continuous logging device. Groundwater samples will be collected from the air sparge wells if no biodegradation is detected at the observation wells. Analysis would be for BTEX, DEHP, and the MNA parameters from routine program.
- Observation wells monitoring groundwater quality will be analyzed as follows:
    - Field parameters – DO, pH, ORP, conductivity, turbidity, temperature, ferrous iron, alkalinity, and carbon dioxide.
    - Laboratory parameters – BTEX, and DEHP, heterotrophic plate count, TSS, TDS, nitrate nitrogen, ammonia nitrogen, total phosphorus, sulfate, and methane.
    - Frequency – twice prior to startup, weekly for 4 weeks upon startup, every other week after 4 weeks.
    - Sampling methods – low flow sampling using the same methods as the routine monitoring program.
    - Sample depth – at the water table.

6.4 Survey

A survey of each permanent monitoring point will be conducted by a New Jersey licensed surveyor. A permanent water level mark will be etched into the top pf the inner well casing and surveyed to the nearest hundredth of a foot in relation to the permanent on-site datum.

Each sample location will be surveyed horizontally to an accuracy of one-tenth of a second latitude and longitude.

6.5 Supplemental Remedial Investigation Report

A supplemental Remedial Investigation Report (RI Report) will be prepared to present the results of this RIW in accordance with N.J.A.C. 7:26E-4.8 and consistent with the scope of this investigation. This report will utilize the existing RI Report to the extent applicable.

.

Tables

Table 1 ~ PRINCIPAL PERSONNEL CONTACT INFORMATION
L.E. CARPENTER COMPANY (LEC)
WHARTON, MORRIS COUNTY, NEW JERSEY, USEPA ID No. NJD00216878

NAME & TITLE	PROJECT RESPONSIBILITY	PROJECT AUTHORITY	COMPANY NAME & ADDRESS	CONTACT INFORMATION
Ernie Schaub Project Manager, Environmental Health & Safety	LEC Project Manager	Owner	**L.E. Carpenter & Company** 33587 Walker Road Avon Lake, OH 44012	(440) 930-3611 Phone (440) 930-1063 Fax ernie.schaub@polyone.com
Richard Hahn Senior Legal Council & Assistant Secretary	LEC Internal Legal Council	Owner/Secretary	**L.E. Carpenter & Company** 33587 Walker Road Avon Lake, OH 44012	(440) 930-1361 Phone (440) 930-1179 Fax richard.hahn@polyone.com
Nicholas J. Clevett Client Service Manager & Senior Project Manager	LEC Project Manager	Agent for Owner	**RMT, Inc.** 2025 E. Beltline Ave. SE, Suite 402 Grand Rapids, MI 49546	(616) 975-5415, ext. 1405 Phone (616) 975-1098 Fax (616) 780-2398 Mobile nicholas.clevett@rmtinc.com
James J. Dexter, C.P.G. Senior Consultant	LEC Senior Hydrogeologist	Licensed NJ Professional Geologist	**RMT, Inc.** 2025 E. Beltline Ave. SE, Suite 402 Grand Rapids, MI 49546	(616) 975-5415, ext. 1407 Phone (616) 975-1098 Fax (616) 915-3658 Mobile jim.dexter@rmtinc.com
Dan Oman, P.E. Senior Consultant	LEC Senior Engineer	Licensed NJ Professional Engineer	**RMT, Inc.** 3754 Ranchero Drive Ann Arbor, MI 48108	(734) 971-7080, ext. 7174 Phone (734) 971-9022 Fax (734) 604-0653 Mobile dan.oman@rmtinc.com
Eric Vincke Environmental Scientist	LEC Technical Coordinator		**RMT, Inc.** 2025 E. Beltline Ave. SE, Suite 402 Grand Rapids, MI 49546	(616) 975-5415, ext. 1403 Phone (616) 975-1098 Fax (616) 340-0382 Mobile eric.vincke@rmtinc.com
Dave Condon Site Supervisor	LEC Site Contact		**L.E. Carpenter & Company** 170 North Main Street P.O. Box 11 Wharton, NJ 07885	(973) 366-9577 Phone (973) 366-5837 Fax
Leslie Newton Sr. Technical Representative	Analytical Laboratory Services		**Environmental Science Corp.** 12065 Mt. Lebanon Road Mt. Juliet, TN 37122	(800) 767-5859 Phone (615) 758-5859 Fax lnewton@envsci.com
David Pohwat VP Business Development	Waste Broker		**Environmental Waste Minimization** 14 Brick Kiln Ct. Northhampton, PA 18067	(484) 275-6930 Phone (484) 275-6970 Fax dpohwat@ewmi-info.com
James M. Stewart President	Professional Surveyor		**James M. Stewart, Inc.** 9622 Evans Street Philadelphia, PA 19115	(215) 969-1577 Phone (215) 969-0338 Fax jmssurveys@comcast.net
David Maher Boart Longyear	Professional Driller		**Boart Longyear, DL Maher Division** 71 Concord Street North Reading, MA 01864	(781) 933-3210 Phone (978) 664-3299 Fax dmaher@boartlongyear.com
Jennifer Rice Senior Ecological Resource Specialist	Wetland Specialist		**JFNew** 11181 Marwill Avenue West Olive, MI 49460	(616) 847-1680 Phone (616) 847-9970 Fax krice@jfnew.com
Glenn Savary Case Manager	NJDEP Case Manager	Regulator	**New Jersey Department of Environmental Protection (NJDEP)** Bureau of Case Management 401 East State Street P.O. Box 028 Trenton, NJ 08626	(609) 633-1455 Phone (609) 633-1439 Fax Glenn.Savary@dep.state.nj.us
Gwen Zervas, P.E. Section Chief	NJDEP Section Chief (*Former Case Manager)*	Regulator	**New Jersey Department of Environmental Protection (NJDEP)** Bureau of Case Management 401 East State Street P.O. Box 028 Trenton, NJ 08626	(609) 633-1455 Phone (609) 633-1439 Fax
Patricia Simmons Pierre Project Manager	USEPA Project Manager	Regulator	**United States Environmental Protection Agency (USEPA)** 290 Broadway Floor 19 New York, NY 10007	(212) 637-3865 Phone (212) 637-3966 Fax pierre.patricia@epa.gov
Jon Rheinhardt CFO/Administrator	Main Borough Point of Contact		**Borough of Wharton** Wharton Municipal Building 10 Roberts Street Wharton, NJ 07885	(973) 361 8444, ext. 11 Phone (973) 361-5281 Fax (973) 713-5518 Mobile Jrheinhardt@whartonnj.com

TABLE 2

2nd Quarter 2008

L.E. Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey

Quarterly Groundwater Elevations

WELL LOCATION	MONITORING DEVICE TYPE	PROFESSIONAL SURVEY INFORMATION [2]					QUARTERLY MEASUREMENT INFORMATION		
		BASELINE LOCATION (FT) NJ State Plane Coordinates		ELEVATION (FT. MSL)					
		(Y) North	(X) East	GROUND [6]	OUTER CASING	INNER WELL CASING	MEAS. DATE	WATER DEPTH	WATER ELEVATION
GEI-2I	Piezometer	754573.99	470499.76	635.32	637.75	637.60	5-May-08	10.31	627.29
GEI-2S	Piezometer	754566	470506.18	634.86	637.27	637.07	5-May-08	10.19	626.88
GEI-3I	Piezometer	754311.79	470453.7	636.96	639.39	639.25	5-May-08	12.47	626.78
MW-8	Monitoring Well	754099.29	471251.06	627.39	629.96	628.19	5-May-08	2.76	625.43
MW-9	Monitoring Well	754075.94	471111.03	628.61	631.09	629.58	5-May-08	3.51	626.07
MW-12S(R)	Monitoring Well	754055.97	471042.34	631.57	634.26	633.73	5-May-08	7.54	626.19
MW-13S	Monitoring Well	754353.97	471370.04	627.74	630.80	630.63	5-May-08	5.15	625.48
MW-13S(R)	Monitoring Well	754333.07	471365.71	627.66	630.36	629.99	5-May-08	4.48	625.51
MW-13I	Monitoring Well	754337.8	471360.31	627.76	630.28	630.06	5-May-08	4.41	625.65
MW-15S	Monitoring Well	754326.58	470891.83	634.23	636.43	636.17	5-May-08	10.04	626.13
MW-15I	Monitoring Well	754325.8	470901.47	634.14	636.28	636.06	5-May-08	10.01	626.05
MW-17	Monitoring Well	754109.68	470759.85	632.35	634.32	634.19	5-May-08	7.89	626.30
MW-18S	Monitoring Well	754677.95	471117.26	627.62	630.88	630.66	5-May-08	4.98	625.68
MW-18I	Monitoring Well	754675.11	471106.07	627.75	630.59	630.44	5-May-08	4.35	626.09
MW-21 [3]	Monitoring Well	754240.97	471645.78	624.57	628.49	628.20	5-May-08	2.92	625.28
MW-25(R) [3]	Monitoring Well	754201.83	471518.21	624.65	626.77	626.62	5-May-08	2.21	624.41
MW-27s	Monitoring Well	754253.78	470672.69	635.82	635.78	635.07	5-May-08	8.71	626.36
MW-28S	Monitoring Well	754243.26	471034.34	628.20	631.28	631.14	5-May-08	5.53	625.61
MW-28I	Monitoring Well	754242.87	471031.19	628.25	631.20	631.04	5-May-08	5.35	625.69
MW-29S	Monitoring Well	754411.14	471187.85	629.94	632.83	632.66	5-May-08	7.22	625.44
MW-30S	Monitoring Well	754281.65	471265.12	624.99	628.24	628.24	5-May-08	2.84	625.40
MW-30I	Monitoring Well	754286.42	471263.15	625.14	628.15	628.01	5-May-08	2.68	625.33
MW-30D	Monitoring Well	754290.05	471261.2	625.20	628.22	628.02	5-May-08	2.69	625.33
SG-D1 [1]	Drainage Channel Staff Gauge	754428.57	471240.37	625.81	-	-	25-Jun-07	NM	NM
SG-D2 [1]	Drainage Channel Staff Gauge	754285.43	471361.24	626.26	-	-	25-Jun-07	NM	NM
SG-D3 [1]	Drainage Channel Staff Gauge	754381.47	471548.31	625.83	-	-	25-Jun-07	NM	NM
SG-R1 [1]	Rockaway River Staff Gauge	754313.99	470408.70	640.92	-	-	11-Sep-06	NM	- -
SG-R2 [3]	Rockaway River Monitoring Point	754056.10	470946.46	629.41	-	-	5-May-08	2.53	626.88
SW-R-1 [4]	Rockaway River Monitoring Point	754125.56	471523.00	625.87	-	-	5-May-08	2.45	623.42
SW-R-2 [4]	Rockaway River Monitoring Point	754112.82	471426.51	626.54	-	-	5-May-08	2.54	624.00
SW-R-3 [4]	Rockaway River Monitoring Point	754149.30	471368.76	626.25	-	-	5-May-08	1.63	624.62
SW-R-4 [4]	Rockaway River Monitoring Point	754088.00	471279.58	627.57	-	-	5-May-08	2.30	625.27
SW-R-5 [4]	Rockaway River Monitoring Point	754314.04	470408.85	640.66	-	-	5-May-08	1.63	639.03
SW-R-6 [4]	Rockaway River Monitoring Point	754071.52	470697.75	631.68	-	-	5-May-08	NM-damaged	--
SW-D-1 [5]	Drainage Channel Staff Gauge	754428.36	471240.17	625.75	-	-	5-May-08	1.70	624.05
SW-D-2 [5]	Drainage Channel Staff Gauge	754285.35	471361.22	626.07	-	-	5-May-08	2.93	623.14
SW-D-3 [5]	Drainage Channel Staff Gauge	754381.23	471548.18	625.70	-	-	5-May-08	1.46	624.24
SW-D-4	Drainage Channel Monitoring Point	754297.19	471292.08	624.93	-	-	5-May-08	0.79	624.14
SW-D-5	Drainage Channel Monitoring Point	754223.14	471920.10	626.86	-	-	5-May-08	2.82	624.04
DRC-2	Drainage Channel Monitoring Point	754117.49	471971.58	623.29	-	-	5-May-08	1.90	621.39

FOOTNOTES

(1) Reference elevation measured at the top of a 3.33 ft. Staff gauge. Water depth based on a visual observation of the water level on the Staff gauge.

(2) Horizontal Datum: New Jersey State Plane Coordinate System NAD 83. Vertical Datum: NAVD 88

(3) New SG-R2 replaced the old SG-R2 installed in Nov. 1998. Professional survey performed by James M. Stewart, Inc., Philadelphia, PA May 2004. SG-R2 is a chiseled arrow on Iron Beam

(4) As outlined in the PRMP the six (6) new Rockaway River monitoring points reference survey elevation was shot at the top of a stake installed to each point

(5) SW-D-1, SW-D-2 and SW-D-3 were resurveyed points at the top of the stake that secures each drainage ditch staff gauge.
These points were reshot to insure the reference elevation integrity remained for each of the 3 staff gauges as a result of source reduction remedial disturbance.

(6) Ground reference elevation for SG and SW series gauges and monitoring points is a point specific to each devise (*i.e.,* top of stake, to of gauge, notched point on concrete or iron, *etc.*)

TABLE 2 CONTINUED
L.E. Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey
Quarterly Wetland Area Groundwater Elevations

2nd Quarter 2008

WELL LOCATION	MONITORING DEVICE TYPE	PROFESSIONAL SURVEY INFORMATION [1]					QUARTERLY MEASUREMENT INFORMATION						
		BASELINE LOCATION (FT) NJ State Plane Coordinates		ELEVATION (FT. MSL)									
		(Y) North	(X) East	GROUND [6]	OUTER CASING	INNER WELL CASING	MEAS. DATE	PRODUCT DEPTH	WATER DEPTH	PRODUCT ELEVATION	WATER ELEVATION	PRODUCT THICKNESS (FT)	CORRECTED WATER ELEVATION
MW-31S	Monitoring Well	754241.65	471341.5	627.94	630.00	629.82	5-May-08	--	4.80	--	625.02		
MW-32S	Monitoring Well	754207.08	471359.83	628.15	630.33	630.18	5-May-08	5.86	5.96	624.32	624.22	0.10	624.31
MW-33S	Monitoring Well	754170.51	471311.04	628.85	631.06	630.91	5-May-08	--	5.91	--	625.00		
MW-34S	Monitoring Well	754178.83	471399.49	628.07	629.97	629.93	5-May-08	--	5.39	--	624.54		
MW-35S	Monitoring Well	754179.62	471445.17	627.43	629.59	629.19	5-May-08	--	4.65	--	624.54		

FOOTNOTES
(1) Horizontal Datum: New Jersey State Plane Coordinate System NAD 83. Vertical Datum: NAVD 88
(2) Corrected water level elevations utilize an average specific gravity of 0.9363 (RMT, Inc. product samplig in October 1999)

TABLE 3
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Groundwater Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS						
	SAMPLE DATE	QUARTER	Benzene	Ethylbenzene	Toluene	Total Xylenes	bis-2-Ethylhexylphthalate (DEHP)
		UNITS	ug/l	ug/l	ug/l	ug/l	ug/l
		SOLUBILITY LIMIT	1,700,000	152,000	515,000	175,000	334
		PRACTICAL QUANTITATION LIMIT [PQL]	1	2	1	2	3
		NEW JERSEY GROUNDWATER QUALITY STANDARDS (NJGWQS) CLASS IIA	0.2	700	1,000	1,000	2
		HIGHER OF NJGWQS AND PQL	1	700	1,000	1,000	3
MW19							
Dilution factor for BTEX 2000	24-Feb-95	1	< ***660***	***1,700***	***110,000***	***10,000***	NR
Dilution factor for BTEX 100	14-Jun-95	2	***150***	***3,400***	***140,000***	***17,000***	NS
Dilution factor 5000 for BTEX & 2 for DEHP; MDL for Benzene 1000 ug/l	24-Apr-98	2	< ***1,000***	***2,850***	***76,700***	***14,900***	***7***
Dilution factor for BTEX 500	2-Aug-01	3	< ***95***	***3,000***	***62,000***	***17,000***	3
Dilution factor for BTEX 1000	6-Jun-02	2	< ***200***	***1,000***	***30,000***	***6,000***	***6***
Dilution factor for BTEX 100, Toluene 200	20-Nov-03	4	< ***20***	***1,500***	***40,000***	***7,400***	J ***6***
	15-Jun-04	2	< ***100***	***1,400***	***46,000***	***6,600***	J ***4***
Dilution factor for BTEX 100, Toluene 500	10-Aug-04	3	< ***20***	***2,100***	***56,000***	***11,000***	J 2
Dilution factor for BTEX 50	13-Jan-05	1	< ***10***	***750***	***18,000***	***3,600***	< 1
Lower Grab Water Sample; Dilution factor for BTEX 5	8-Apr-05	2	< 1	97	***1,300***	530	J 3
Upper Grab Water Sample; Dilution factor for Toluene 5	8-Apr-05	2	< 0.2	86.0	410.0	430.0	J 3.0
Dillution factor for BTEX 200	27-Jul-05	3	< ***40***	***1,100***	***44,000***	***6,000***	J 2
Dillution factor for BTEX 100	27-Oct-05	4	< ***20***	200	***10,000***	***1,200***	J ***5***
Dillution factor for BTEX 250	28-Feb-06	1	< ***50***	***880***	***28,000***	***4,900***	J 3
Dillution factor for BTEX 200	20-Jun-06	2	< ***40***	***1,600***	***53,000***	***8,700***	J 3
Dillution factor for BTEX 200	13-Sep-06	3	< ***40***	***2,100***	***51,000***	***11,000***	J 3
Dillution factor for BTEX 200	8-Nov-06	4	< ***40***	***2,200***	***59,000***	***11,000***	J 2
Dillution factor for BTEX 500	8-Feb-07	1	< ***500***	***1,900***	***93,000***	***9,800***	< 1
Dillution factor for BTEX 50, Toluene 200	27-Jun-07	2	< ***50***	680	***32,000***	***3,000***	< 1
Dillution factor for BTEX 100, Toluene 500	12-Sep-07	3	< ***100***	***1,500***	***76,000***	***7,300***	3
Dilution factor for BTEX 250, DEHP 1.1	4-Dec-07	4	< ***250***	***1,500***	***49,000***	***7,500***	< 1
	20-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1
Dillution factor for BEX 100, Toluene 200, DEHP 1.05	7-May-08	2	< ***100***	650	***26,000***	***2800***	< 1
MW19-4							
	12-Mar-98	1	< 0.2	< 0.1	< 0.1	< 0.5	< 1.3
	2-Aug-01	3	< 0.2	< 0.2	< 0.2	< 0.2	< 0.5
	6-Jun-02	2	< 0.22	< 0.18	< 0.24	< 0.20	< 0.50
	19-Nov-03	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	28-Feb-06	1	< 0.2	< 0.2	2.2	< 0.6	< 1.0
	21-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	12-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	12-Sep-06	3duplicate	< 0.2	< 0.2	< 0.2	< 0.6	< 0.9
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dilution factor for DEHP 10	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	***17***
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	4-Dec-07	4duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dilution factor for DEHP 1.11	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	1.1
Dilution factor for DEHP 1.11	6-May-08	2 duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.1
MW19-5							
Dilution factor for BTEX 5000	12-Mar-98	1	< ***1,000***	***1,920***	***123,000***	***10,100***	***42***
Dilution factor for BTEX 1000	2-Aug-01	3	< ***190***	***870***	***79,000***	***5,200***	***3***
Dilution factor for BTEX 500	7-Mar-02	1	< ***140***	300	***10,000***	***1,700***	1
Dilution factor for BTEX 5000, for DEHP 20	5-Jun-02	2	< ***1,100***	***1,100***	***92,000***	***6,300***	< ***10***
Dilution factor for BTEX 5000, for DEHP 20	5-Jun-02	2duplicate	< ***1,100***	***1,300***	***92,000***	***6,900***	< ***9***
	19-Nov-03	4	< 0.2	< 0.2	4.3	J 0.9	< 0.9
	18-Dec-03	4resample	< 0.2	3.7	240.0	24.0	< 0.9
	16-Jun-04	2	< ***100***	***1,400***	***83,000***	***7,400***	J 1
	10-Aug-04	3	< ***200***	***2,800***	***140,000***	***14,000***	J 1
Dilution factor for BTEX 10	13-Jan-05	1	< ***2***	64	***3,100***	340	< 1
Dilution factot for BTEX 200, Lower Grab Water Sample	9-Apr-05	2	< ***40***	***1,000***	***27,000***	***5,300***	J 1
Upper Grab Water Sample	9-Apr-05	2	< 0.2	J 0.4	9.5	J 2.3	< 1.0
Dillution factor for BTEX 500	26-Jul-05	3	< ***100***	***2,600***	***100,000***	***13,000***	< 1
	27-Oct-05	4	< 0.2	6.8	140.0	37.0	< 1.0
Dillution factor for BTEX 100	28-Feb-06	1	< ***20***	290	***19,000***	***1,500***	< 1
Dillution factor for BTEX 20	20-Jun-06	2	< ***4***	130	***4,000***	730	< 1
Dillution factor for BTEX 100	13-Sep-06	3	< ***20***	550	***25,000***	***2,800***	< 1
Dillution factor for BTEX 100	8-Nov-06	4	< ***20***	410	***22,000***	***2,000***	***9***
Dillution factor for BTEX 500	8-Feb-07	1	< ***500***	***2,100***	***98,000***	***10,000***	< 1
Dillution factor for BTEX 100, Toluene 1000	27-Jun-07	2	< ***100***	***1,700***	***98,000***	***8,200***	< 1
Dillution factor for BTEX 100, Toluene 500	12-Sep-07	3	< ***100***	***1,100***	***67,000***	***5,200***	1

TABLE 3
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Groundwater Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS						
	SAMPLE DATE	QUARTER	Benzene	Ethylbenzene	Toluene	Total Xylenes	bis-2-Ethylhexylphthalate (DEHP)
		UNITS	ug/l	ug/l	ug/l	ug/l	ug/l
		SOLUBILITY LIMIT	1,700,000	152,000	515,000	175,000	334
		PRACTICAL QUANTITATION LIMIT [PQL]	1	2	1	2	3
		NEW JERSEY GROUNDWATER QUALITY STANDARDS (NJGWQS) CLASS IIA	0.2	700	1,000	1,000	2
		HIGHER OF NJGWQS AND PQL	1	700	1,000	1,000	3
Dillution factor for BEX 200, Toluene 50, DEHP 1.1	4-Dec-07	4	< ***200***	***820***	***4,400***	***4,200***	< 1
	20-Feb-08	1	< 1	8	190	45	< 1
Dillution factor for Toluene 5 [DUP-03]	20-Feb-08	1duplicate	< 1	6	200	34	< 1
Dillution factor for BEX 5, Toluene 100, DEHP 1.05	7-May-08	2	***7.2***	270	***15,000***	***1,300***	< 1
MW19-6							
Dilution factor for BTEX 200	15-Nov-99	4	< ***62***	94	***3,400***	500	***32***
Dilution factor for BTEX 2	1-Aug-01	3	< 0.4	14.0	390.0	47.0	***28***
	5-Jun-02	2	< 0.22	1.70	13.00	4.10	2.30
	18-Nov-03	4	< 0.2	< 0.2	J 0.3	< 0.6	J ***6.0***
	17-Jun-04	2	< 0.2	J 0.4	1.1	1.2	J 3.0
	10-Aug-04	3	< 0.2	4.6	38.0	18.0	J ***4.0***
	13-Jan-05	1	< 0.2	4.0	36.0	14.0	J 1.0
Lower Grab Water Sample	9-Apr-05	2	< 0.2	16.0	160.0	64.0	< 1.0
Upper Grab Water Sample	9-Apr-05	2	< 0.2	11.0	74.0	37.0	< 1.0
	26-Jul-05	3	< 0.2	3.6	27.0	14.0	J 2.0
	27-Oct-05	4	< 0.2	5.4	110.0	25.0	< 0.9
	28-Feb-06	1	< 0.2	5.8	65.0	23.0	< 1.0
	20-Jun-06	2	< 0.2	1.7	3.2	5.0	< 1.0
	20-Jun-06	2duplicate	< 0.2	1.7	3.2	4.9	< 1.0
	12-Sep-06	3	< 0.2	J 0.3	1.0	J 0.9	< 1.0
	7-Nov-06	4	< 0.2	J 0.3	< 0.2	J 0.6	< 0.9
	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution for DEHP 1.25	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
MW19-7							
Dilution factor for BTEX 50	15-Nov-99	4	< ***16***	100	51	***1,400***	< ***4***
Dilution factor for BTEX 2	1-Aug-01	3	***6.7***	6.6	13.0	680	< 0.4
Dilution factor for BTEX 5	7-Mar-02	1	***3***	< 1	< 1	250	2
	5-Jun-02	2	0.48	1.60	27.00	27	< 0.40
	19-Nov-03	4	***4.7***	J 0.4	J 0.3	460	J 1.0
	16-Jun-04	2	J ***2.8***	130.0	***2,100.0***	630	< 1.0
	16-Jun-04	2duplicate	J ***4***	130	***2,100***	610	< 1
	10-Aug-04	3	***2***	2	1	20	< 1
Dilution factor for BTEX 2	12-Jan-05	1	***6.1***	90.0	240.0	760	< 1.0
	12-Jan-05	1duplicate	***2.9***	45.0	120.0	380	< 1.0
Lower Grab Water Sample; Dilution factor for BTEX 25	7-Apr-05	2	J ***9.5***	210.0	***2,700***	***1,400***	< 1.0
Upper Water Grab Sample; Dilution factor for BTEX 10	7-Apr-05	2	J ***13***	370	***5,600***	***2,300***	< 1
Lower Grab Water Sample	27-Jul-05	3	***2.2***	< 0.2	J 0.2	J 1.7	< 0.9
Upper Grad Water Sample	27-Jul-05	3	***1.5***	< 0.2	J 0.5	J 2.4	< 1.0
Dilution factor for BTEX 200	27-Oct-05	4	J ***62***	***710***	***16,000***	***3,600***	< 1
Dilution factor for Total Xylenes 5	28-Feb-06	1	***7.5***	4.9	J 0.3	870	< 1.0
Dilution factor for Total Xylenes 5	28-Feb-06	1duplicate	***7.5***	5.0	J 0.3	840	< 0.9
	20-Jun-06	2	***6.5***	19.0	J 0.6	550	< 1.0
Dilution factor for Total Xylenes 5	12-Sep-06	3	***4.9***	33.0	J 0.3	440	< 1.0
	8-Nov-06	4	***2.6***	< 0.2	< 0.2	26	< 0.9
	7-Feb-07	1	***2.6***	< 1.0	< 5.0	< 3.0	< 1.0
	7-Feb-07	1duplicate	***2.6***	< 1.0	< 5.0	< 3.0	< 1.0
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	23	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution for DEHP 1.1	5-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.1
	19-Feb-08	1	< 1.0	7.3	55.0	36	< 1.0
Dillution for DEHP 1.05	7-May-08	2	< 1.0	< 1.0	< 5.0	5.6	< 1.0
MW19-12	21-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	12-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	7-Nov-06	4duplicate	< 0.2	< 0.2	< 0.2	< 0.6	< 0.9
	6-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0

TABLE 3
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Groundwater Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS						
	SAMPLE DATE	QUARTER	Benzene	Ethylbenzene	Toluene	Total Xylenes	bis-2-Ethylhexylphthalate (DEHP)
		UNITS	ug/l	ug/l	ug/l	ug/l	ug/l
		SOLUBILITY LIMIT	1,700,000	152,000	515,000	175,000	334
		PRACTICAL QUANTITATION LIMIT [PQL]	1	2	1	2	3
		NEW JERSEY GROUNDWATER QUALITY STANDARDS (NJGWQS) CLASS IIA	0.2	700	1,000	1,000	2
		HIGHER OF NJGWQS AND PQL	1	700	1,000	1,000	3
	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution for DEHP 1.11	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.1
GEI-2S							
	24-Feb-95	1	< ***8.2***	46.0	***1,500***	380.0	***7.6***
	25-Mar-98	1	NS	NS	NS	NS	B 2.5
	6-Jun-02	2	***1.2***	2.6	16.0	5.1	2.4
	18-Dec-03	4	< 0.2	< 0.2	J 0.4	< 0.6	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution for DEHP 1.18	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
MW-25R							
	21-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	21-Jun-06	2duplicate	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	13-Sep-06	3	< 0.2	< 0.2	J 0.5	< 0.6	J 1.0
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	8-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2duplicate	< 1.0	< 1.0	< 5.0	< 3.0	1.6
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP is 1.3	6-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.3
	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution for DEHP 1.29	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.3
MW-27s							
	22-Jun-06	2	J 0.6	3.7	3.9	14	J 3.0
	11-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	J 2.0
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	J 1.0
	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	1.2
Dillution factor for DEHP is 1.4	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.4
Dillution factor for DEHP is 1.18	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
Dillution factor for DEHP is 1.18	7-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
MW-28s							
Dillution factor for BTEX 5	21-Jun-06	2	J ***1.6***	560.0	< 1.0	***1,400***	***100***
Dillution factor for Xylene is 5, DEHP is 10	13-Sep-06	3	J 0.2	210.0	< 0.2	450	***570***
Dillution factor for Xylene is 5, DEHP is 10	13-Sep-06	3duplicate	J 0.3	220.0	< 0.2	470	***550***
Dilution factor for DEHP 10	7-Nov-06	4	< 0.2	92.0	< 0.2	180	***250***
Dillution factor for DEHP is 20	7-Feb-07	1	< 1.0	70.0	< 5.0	150	***260***
Dillution factor for DEHP is 20	7-Feb-07	1duplicate	< 1.0	58.0	< 5.0	130	***250***
	27-Jun-07	2	< 1.0	30.0	< 5.0	56	***28***
Dillution factor for DEHP is 5	12-Sep-07	3	< 1.0	17.0	< 5.0	42	***49***
Dillution for DEHP is 1.2	6-Dec-07	4	< 1.0	32.0	< 5.0	96	***14***
Dillution for DEHP is 20	20-Feb-08	1	< 1.0	14.0	< 5.0	36	***39***
Dillution for DEHP is 11.1	7-May-08	2	< 1.0	2.7	< 5.0	6.6	***160***
MW-28i							
Dillution factor for BTEX 5	22-Jun-06	2	< 1.0	480.0	< 1.0	***1,300***	***270***
Dillution factor for Xylene and DEHP is 5	13-Sep-06	3	< 0.2	72.0	J 0.6	520	***180***
	7-Nov-06	4	< 0.2	10.0	< 0.2	14	***90***
Dillution factor for DEHP is 10	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	***76***
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	***3.9***
	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	***21***
Dillution for DEHP is 1.3	6-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	1.4
Dillution for DEHP is 5	20-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	***31***
Dillution for DEHP is 1.11	7-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	***28***
MW-29s							
	22-Jun-06	2	< 0.2	J 0.2	< 0.2	J 0.6	J 1.0
	14-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	J 1.0
	9-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	***31***
	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Deillution for DEHP 1.2	5-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0

TABLE 3
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Groundwater Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS						
	SAMPLE DATE	QUARTER	Benzene	Ethylbenzene	Toluene	Total Xylenes	bis-2-Ethylhexylphthalate (DEHP)
		UNITS	ug/l	ug/l	ug/l	ug/l	ug/l
		SOLUBILITY LIMIT	1,700,000	152,000	515,000	175,000	334
		PRACTICAL QUANTITATION LIMIT [PQL]	1	2	1	2	3
		NEW JERSEY GROUNDWATER QUALITY STANDARDS (NJGWQS) CLASS IIA	0.2	700	1,000	1,000	2
		HIGHER OF NJGWQS AND PQL	1	700	1,000	1,000	3
Dillution factor for DEHP 1.05 [DUP-02]	19-Feb-08	1duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP 1.18	7-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
MW-30s							
	21-Jun-06	2	< 1.0	***1,200***	J 1.3	***3,900***	***740***
Dilution factor for BTEX 20, DEHP is 500	13-Sep-06	3	< ***4.0***	***1,200***	46.0	***5,100***	***19,000***
Dilution factor for BTEX 5, DEHP is 100	9-Nov-06	4	< 1.0	540	< 1.0	***2,600***	***2,500***
	7-Feb-07	1	NS - frozen	NS - frozen	NS - frozen	NS - frozen	NS - frozen
Dilution factor for BTEX 5, DEHP is 2000	26-Jun-07	2	***2.1***	300	< 25	***1,200***	***13,000***
Dilution factor for DEHP is 50	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	***880***
Dilution factor for DEHP is 200	12-Sep-07	3duplicate	< 1.0	< 1.0	< 5.0	< 3.0	***1,700***
Dillution factor for DEHP is12, BTEX is 5	6-Dec-07	4	***1.5***	34.0	110	260	***200***
Dillution factor for DEHP is 111, BTEX is 5	20-Feb-08	1	< ***5.0***	110	< 25	480	***3,800***
Dillution factor for Total Xylene is 5, DEHP is 1.25	8-May-08	2	< 1.0	100	< 5.0	460	***9.6***
MW-30i							
	21-Jun-06	2	J 0.3	38	1.4	170	J 2.0
	13-Sep-06	3	< 0.2	1.5	< 0.2	4.9	***19***
	8-Nov-06	4	< 0.2	J 0.2	< 0.2	< 0.6	J 1.0
	8-Nov-06	4duplicate	< 0.2	J 0.2	< 0.2	< 0.6	< 1.0
	7-Feb-07	1	NS - frozen	NS - frozen	NS - frozen	NS - frozen	NS - frozen
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	1.3
Dillution factor for DEHP 1.2	6-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
Dillution factor for DEHP 1.05	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP 1.05	7-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP 1.18	7-May-08	2duplicate	< 1.0	< 1.0	< 5.0	< 3.0	< 1.2
MW-30d							
	21-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	J 3.0
	14-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	J ***9.0***
	8-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 0.9
	7-Feb-07	1	NS - frozen	NS - frozen	NS - frozen	NS - frozen	NS - frozen
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP 1.1	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.1
Dillution factor for DEHP 1.1	4-Dec-07	4duplicate	< 1.0	< 1.0	7.7	< 3.0	< 1.1
Dillution factor for DEHP 1.05	19-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Dillution factor for DEHP 1.05	7-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
MW-31s							
Dillution factor for BTEX 500, DEHP 83.5	8-May-08	2	< ***500***	***5,500***	< ***2,500***	***27,000***	***310***
MW-32s							
Dillution factor for BTEX 200, DEHP 121000	8-May-08	2	< ***200***	***16,000***	< 1,000	***75,000***	***370,000***
MW-33s							
Dillution factor for DEHP 1.25	8-May-08	2	***4***	6.6	< 5.0	27	***16***
MW-34s							
Dillution factor for Ethylbenzene and Total Xylenes 5 and for DEHP 1.33	6-May-08	2	***1.3***	230	< 5.0	***1,200***	3.0
MW-35s							
Dillution factor for Ethylbenzene and Total Xylenes 500, DEHP 57	6-May-08	2	***1.3***	230	< 5.0	***1,200***	***490***
Atmospheric Blank	13-Jan-05	1	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	8-Apr-05	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	26-Jul-05	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	27-Oct-05	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	28-Feb-06	1	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	20-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	12-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	8-Feb-07	1	< 1.0	< 1.0	J 1.9	< 3.0	< 1.0
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	11-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0

TABLE 3
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Groundwater Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS						
	SAMPLE DATE	QUARTER	Benzene	Ethylbenzene	Toluene	Total Xylenes	bis-2-Ethylhexylphthalate (DEHP)
		UNITS	ug/l	ug/l	ug/l	ug/l	ug/l
		SOLUBILITY LIMIT	1,700,000	152,000	515,000	175,000	334
		PRACTICAL QUANTITATION LIMIT [PQL]	1	2	1	2	3
		NEW JERSEY GROUNDWATER QUALITY STANDARDS (NJGWQS) CLASS IIA	0.2	700	1,000	1,000	2
		HIGHER OF NJGWQS AND PQL	1	700	1,000	1,000	3
	5-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
ATM-01	20-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
ATM-01, Dillution factor for DEHP 1.08	6-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.1
Rinsate Blank	14-Jan-05	1	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	9-Apr-05	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	27-Jul-05	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	27-Oct-05	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	28-Feb-06	1	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	21-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	22-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	13-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	14-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	9-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	9-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	< 1.0
	8-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	8-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	10-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	12-Sep-07	3	< 1.0	< 1.0	< 5.0	< 3.0	1.1
	6-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	2.7
	6-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
RB-02	20-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
RB-03	20-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
	5-May-08	2	< 1.0	< 1.0	< 5.0	< 3.0	< 1.0
Trip Blank	13-Jan-05	1	< 0.2	< 0.2	< 0.2	< 0.6	NA
	9-Apr-05	2	< 0.2	< 0.2	< 0.2	< 0.6	NA
	27-Jul-05	3	< 0.2	< 0.2	< 0.2	< 0.6	NA
	27-Oct-05	4	< 0.2	< 0.2	< 0.2	< 0.6	NA
	28-Feb-06	1	< 0.2	< 0.2	< 0.2	< 0.6	NA
	20-Jun-06	2	< 0.2	< 0.2	< 0.2	< 0.6	NA
	12-Sep-06	3	< 0.2	J 0.2	< 0.2	< 0.6	NA
	13-Sep-06	3	< 0.2	< 0.2	< 0.2	< 0.6	NA
	6-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	NA
	7-Nov-06	4	< 0.2	< 0.2	< 0.2	< 0.6	NA
	7-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	NA
	8-Feb-07	1	< 1.0	< 1.0	< 5.0	< 3.0	NA
	27-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	NA
	26-Jun-07	2	< 1.0	< 1.0	< 5.0	< 3.0	NA
	4-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	NA
	5-Dec-07	4	< 1.0	< 1.0	< 5.0	< 3.0	NA
	18-Feb-08	1	< 1.0	< 1.0	< 5.0	< 3.0	NA

LEGEND

ug/L = micrograms per liter

NJGWQS = New Jersey Groundwater Quality Standards

ROD: Record of Decision

NA = Not Applicable

NS = Not Sampled

ND: No Detection

duplicate = Duplicate sample

Concentration exceeds NJGWQS **1.2**

B: Analyte also detected in blank

J: Estimated value. Value is greater than or equal to the Method Detection Limit (MDL) and less than the Limit of Quantitation (LOQ)

NOTES

(1) Low flow sampling initiated 1st quarter 2002

(2) GEI series wells are piezometers installed by Weston

(3) GEI series wells, MW-19-3, and MW-19-4 are not sampled under revised groundwater monitoring program effective 1Q05.

TABLE 4 **Through 2nd Quarter 2008**

L.E.Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey

Quarterly Groundwater Monitoring

MNA Analytical Data

Well ID	Sampling Event	Heterotrophic Plate Count	Alkalinity to pH 4.5	TSS	TDS	Nitrate Nitrogen	Ammonia Nitrogen	Phosphorus (total)	Sulfate[1]	Methane	Dissolved Lead
	UNITS	cfu/ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
NEW JERSEY GROUNDWATER QUALITY STANDARDS CLASS IIA		NCS		NCS	500	NCS	NCS	NCS	250	NCS	.005[2]
MW-19	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	80	207	30	***589***	ND	ND	0.054	3.6 J	150	NS
	3Q04	630	268	30.9	***553***	ND	ND	0.12	1.7 J	230	NS
	1Q05	350	241	17.2	347	0.22	ND	ND	7.4	230	NS
	2Q05[L]	390	NS	10.8 J	413	2.8	ND	ND	33.3	3.0 J	NS
	2Q05[U]	1,400	NS	15	455	3	ND	ND	30	2.0 J	NS
	3Q05	3	NS	67	***1,070***	0	1.3	ND	6	33	NS
	4Q05	120	NS	23	***620***	1	0.88	ND	37	19	NS
	1Q06	25	NS	36	***559***	ND	ND	ND	3.3 J	140	NS
	2Q06	56	NS	44	460	ND	0.43 J	ND	3.2 J	95	ND
Dilution factor for Methane 5	3Q06	60	NS	13	435	ND	0.43 J	ND	5	310	ND
Dilution factor for Methane 100	4Q06	20	NS	16	411	ND	ND	0	2.9 J	1,700	ND
	1Q07	140		7	340	ND	ND	ND	ND	540	ND
	2Q07	180		20	***1,100***	ND	0.62	ND	ND	380	ND
	3Q07	1,200		23	***710***	ND	0.76	0	ND	300	ND
	4Q07	FS		30	500	ND	0.64	0	ND	680	ND
	1Q08	150		4	190	2	ND	ND	25	ND	ND
Dilution factor for Dissolved Lead 5	2Q08	1,900		26	***1,200***	ND	0.52	ND	ND	650	ND
MW-19-1	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	100	162	ND	***725***	1.4	ND	ND	32.4	ND	NS
	3Q04	49	184	3.2 J	***928***	3.9	ND	ND	35.3	ND	NS
	1Q05	43	152	ND	404	2.1	ND	ND	27.9	ND	NS
	2Q05[L]	410	NS	16.4	***1440***	2.9	ND	ND	34.1	ND	NS
	2Q05[U]	350	NS	3.2 J	***1430***	2.8	ND	ND	32.9	ND	NS
	3Q05	53	NS	9.2 J	***1140***	4.1	ND	ND	39	ND	NS
Dilution factor for Nitrate 2	4Q05	240	NS	12.4	***659***	4.6	ND	ND	44.2	ND	NS
MW-19-2	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	10	335	6.0 J	***704***	ND	ND	ND	33.6	1600	NS
	3Q04	87	176	6.0 J	***916***	0.87	ND	ND	23.9	280	NS
	1Q05	110	395	5.2 J	***568***	0.093 J	0.13 J	ND	69.4	26	NS
	2Q05[L]	160	ND	11.6 J	***780***	0.62	0.17 J	ND	29.6	ND	NS
	2Q05[U]	150	ND	ND	***750***	0.64	ND	ND	29.3	ND	NS
	3Q05	8	NS	3.2 J	***976***	1	0.12 J	ND	27.2	120	NS
	4Q05	220	NS	ND	***864***	0.78	ND	ND	60.3	35	NS
	4Q05D	92	NS	ND	***908***	0.6	ND	ND	62.1	49	NS
MW-19-4	1Q06	12	NS	ND	***730***	2.4	ND	ND	37.4	ND	NS
	2Q06	520	NS	8.4 J	***774***	2.8	ND	ND	45.8	ND	ND
Dilution factor for Nitrate 5	3Q06	85	NS	ND	***740***	4.8	ND	ND	50.9	ND	ND
Dilution factor for Nitrate 5	3Q06D	92	NS	ND	***733***	4.9	ND	ND	50.1	ND	ND
	4Q06	29	NS	ND	***529***	3	ND	ND	47.1	ND	ND
	1Q07	54		3	340	1.7	ND	ND	37	ND	ND
	2Q07	110		1.4	***1100***	1.7	ND	ND	29	ND	ND
	3Q07	160		1.2	***660***	1.8	ND	ND	40	ND	ND
	3Q07D	160		ND	***660***	1.8	ND	ND	40	ND	ND
	4Q07	FS		1.3	***710***	2.6	ND	ND	38	ND	ND
	4Q07D	FS		ND	***730***	2.6	ND	ND	38	ND	ND
	1Q08	270		1.2	***790***	1.8	ND	ND	24	ND	ND
	2Q08	100		2.1	***860***	1.1	ND	ND	32	ND	ND
DUP-02	2Q08D	80		2.1	***870***	1.1	ND	ND	32	ND	ND
MW-19-5	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3Q04	180	228	14	***942***	0.06 J	ND	ND	15.7	2100	NS
	1Q05	380	126	3.6 J	174	0.49	ND	ND	15.8	34	NS
	2Q05[L]	3000	NS	3.6 J	177	ND	ND	ND	12	380	NS
	2Q05[U]	100	NS	3.6 J	141	0.43	ND	ND	8.7	ND	NS
	3Q05	69	NS	6.8 J	463	ND	ND	ND	7.7	1700	NS
	4Q05	58	NS	ND	144	0.38	ND	ND	12.8	3.8 J	NS
	1Q06	12	NS	ND	287	0.97 J	ND	ND	11.2	290	NS
	2Q06	22	NS	9.2 J	190	0.19	ND	ND	14.2	150	ND
Dilution factor for Methane 10	3Q06	30	NS	ND	275	0.12	ND	ND	10.2	700	ND
Dilution factor for Methane 10	4Q06	620	NS	ND	236	0.1	ND	ND	10.9	640	ND
	1Q07	240		7	340	ND	0.51	ND	ND	500	0.011
	2Q07	91		18	350	ND	0.13	ND	ND	570	ND
Dilution factor for Methane 4	3Q07	110		7.8	360	ND	ND	ND	ND	840	ND
	4Q07	FS		5.1	240	0.13	0.14	0.12	7.8	370	ND
	1Q08	380		1.9	120	0.16	ND	ND	7.2	ND	ND
	1Q08D	170		1.8	120	0.15	ND	ND	7.2	ND	ND
	2Q08	560		3.3	370	0.15	ND	ND	13	340	ND
MW-19-6	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	35	151	10.4 J	***1670***	1.6	ND	ND	37.3	140	NS
	3Q04	110	178	18.8	***1240***	1.1	ND	0.062	38.3	140	NS
	1Q05	82	204	11.2 J	***544***	1.7	ND	ND	44	130	NS
	2Q05[L]	23	NS	18	***1180***	1.3	0.29 J	ND	33.5	44	NS

TABLE 4 **Through 2nd Quarter 2008**

L.E.Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Analytical Data

Well ID	Sampling Event	Heterotrophic Plate Count	Alkalinity to pH 4.5	TSS	TDS	Nitrate Nitrogen	Ammonia Nitrogen	Phosphorus (total)	Sulfate[1]	Methane	Dissolved Lead
	UNITS	cfu/ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
NEW JERSEY GROUNDWATER QUALITY STANDARDS CLASS IIA		NCS		NCS	500	NCS	NCS	NCS	250	NCS	.005[2]
	2Q05[U]	160	NS	ND	***1190***	1	ND	ND	32.7	96	NS
	3Q05	90	NS	40.8	***1520***	1.1	ND	ND	35	38	NS
	4Q05	43	NS	10.8 J	***940***	3.5	ND	ND	47.8	43	NS
	1Q06	14	NS	4.4 J	***634***	1.8	ND	ND	36.6	50	NS
	2Q06	14	NS	ND	***802***	2	ND	ND	38.3	44	ND
	2Q06D	15	NS	ND	***790***	2	ND	ND	37.7	45	ND
	3Q06	75	NS	4.4 J	***682***	2.6	ND	ND	37.1	32	ND
	4Q06	240	NS	ND	***574***	2.3	ND	ND	38.3	31	ND
	1Q07	62		5.3	490	2.4	ND	ND	34	21	ND
	2Q07	70		8.7	***1900***	2.9	ND	ND	48	230	ND
	3Q07	100		2.6	***820***	2	ND	ND	40	68	ND
	4Q07	FS		3.2	***710***	2.3	ND	ND	36	87	ND
	1Q08	120		2.6	***650***	1.1	ND	ND	28	78	ND
	2Q08	22		2.9	***1,200***	1.9	ND	ND	32	27	ND
MW-19-7	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	110	142	6.8 J	***2110***	0.21	ND	ND	47.2	5200	NS
	2Q04D	88	152	9.2 J	***2040***	0.21	0.15 J	ND	37.3	5400	NS
	3Q04	2000	175	4.4 J	***1920***	1.5	ND	ND	64.4	2400	NS
Dilution factor for Methane 250	1Q05	75	200	6.0 J	***774***	3.2	ND	ND	29.1	10000	NS
Dilution factor for Methane 250	1Q05D	77	202	7.2 J	***754***	3.2	ND	ND	30.5	11000	NS
	2Q05[L]	32	NS	54	472	ND	0.50 J	0.45	ND	13000	NS
	2Q05[U]	41	NS	48	481	ND	0.35 J	0.32	ND	10000	NS
	3Q05[L]	17	NS	45.6	***1450***	ND	ND	0.3	19.2	2900	NS
	3Q05[U]	17	NS	31.6	***1280***	0.22	0.29 J	0.1	25.7	1600	NS
Dilution factor for Methane 250	4Q05	16	NS	32	***926***	0.16	0.5	0.23	8.9	7700	NS
	1Q06	14	NS	33.2	***621***	ND	ND	0.3	2.2 J	10000	NS
	1Q06D	10	NS	36.8	***628***	ND	ND	0.3	1.6 J	10000	NS
Dilution factor for Methane 200	2Q06	68	NS	16.8	***655***	0.87	ND	0.16	12.9	11000	ND
Dilution factor for Methane 100	3Q06	79	NS	9.2 J	***799***	2.1	ND	0.15	15.1	8600	ND
Dilution factor for Methane 100	4Q06	600	NS	4.4 J	***568***	3.4	ND	ND	31.3	5600	ND
Dilution factor for Methane 4	1Q07	38		18	420	0.59	ND	0.31	11	1200	ND
Dilution factor for Methane 5	1Q07D	40		19	440	0.69	ND	0.31	12	1300	ND
	2Q07	130		4.4	***610***	0.25	ND	ND	12	530	ND
	3Q07	890		1.8	***590***	0.39	ND	ND	16	120	ND
	4Q07	FS		2.2	***1200***	2.6	0.23	ND	21	170	ND
	1Q08	180		6.7	***1600***	3.2	ND	ND	24	300	ND
	2Q08	52		6.8	***1100***	0.24	0.12	ND	17	430	ND
MW-19-8	2Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	45	143	14.4	***1120***	ND	ND	0.15	22.8	79	NS
	3Q04	15	152	7.2 J	***573***	ND	0.24 J	0.12	11.5	790	NS
Dilution factor for Methane 5	1Q05	91	142	25.2	***1150***	ND	ND	0.18	16.3	510	NS
	2Q05	270	NS	20	***796***	ND	ND	ND	23.7	5.3	NS
	3Q05	ND	NS	8.8 J	876	0.33	0.26 J	ND	20.3	74	NS
	4Q05	210	NS	4.4 J	***926***	0.88	ND	ND	24.6	24	NS
MW-19-9D	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	210	211	6.0 J	***621***	0.14	0.33 J	ND	18.2	1300	NS
	3Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1Q05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3Q05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4Q05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-19-10	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	34	109	6.8 J	***563***	ND	ND	ND	18	2.6 J	NS
	3Q04	18	98	10.4 J	***908***	ND	ND	ND	19.2	3.3 J	NS
	3Q04D	22	97.8	10.8 J	***890***	ND	0.24 J	ND	17.9	2.9 J	NS
	1Q05	29	127	5.2 J	***625***	ND	ND	ND	16.9	74	NS
	2Q05[L]	170	NS	32.4	***653***	ND	ND	ND	18.1	48	NS
	2Q05[U]	93	NS	32	***691***	ND	0.12 J	ND	18.3	48	NS
	3Q05	26	NS	10.4 J	***560***	ND	ND	ND	16	ND	NS
	4Q05	56	NS	17.2	***654***	ND	ND	ND	15.3	3.2 J	NS
MW-19-11	1Q05	940	205	4.8 J	***4750***	2.2	ND	ND	65.6	9.9	NS
	2Q05[L]	NS	NS	64	731	ND	0.42 J	ND	18	930	NS
	2Q05[U]	14	NS	27.2	***740***	ND	ND	ND	17.2	1200	NS
	3Q05	63	NS	106	***555***	ND	ND	0.11	21.5	26	NS
Dilution factor for Methane 10	4Q05	80	NS	15.2	***854***	ND	0.32 J	ND	25.5	440	NS
MW-19-12	2Q06	4000	NS	11.2 J	***548***	0.048 J	ND	ND	15.1	4.8 J	ND
Dilution factor for Methane 5	3Q06	170	NS	6.4 J	***822***	0.36	ND	ND	22.9	170	ND
	4Q06	2	NS	4.4 J	***716***	0.22	ND	ND	21.3	130	ND
	4Q06D	2	NS	ND	***718***	0.17	ND	ND	21.8	130	ND
	1Q07	4		5.5	400	0.56	0.12	ND	20	ND	ND
	2Q07	55		ND	240	0.93	ND	ND	13	ND	ND
	2Q07D	8		ND	270	0.93	ND	ND	13	ND	ND

TABLE 4 **Through 2nd Quarter 2008**

L.E.Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Analytical Data

Well ID	Sampling Event	Heterotrophic Plate Count	Alkalinity to pH 4.5	TSS	TDS	Nitrate Nitrogen	Ammonia Nitrogen	Phosphorus (total)	Sulfate[1]	Methane	Dissolved Lead
	UNITS	cfu/ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
NEW JERSEY GROUNDWATER QUALITY STANDARDS CLASS IIA		NCS		NCS	500	NCS	NCS	NCS	250	NCS	.005[2]
	3Q07	73		ND	290	0.89	ND	ND	13	ND	ND
	4Q07	FS		3	260	0.9	ND	ND	11	ND	ND
	1Q08	9		ND	160	0.84	ND	ND	5.7	ND	ND
	2Q08	ND		1.1	220	1	ND	ND	10	ND	ND
MW-25R	2Q06	1100	NS	18.8	340	ND	0.24 J	ND	2.9 J	140	ND
	3Q06	>5700	NS	279	329	ND	0.24 J	0.14	3.3 J	30	ND
	4Q06	1000	NS	16.8	331	ND	ND	ND	6.2	25	ND
	1Q07	240		49	300	ND	0.12	ND	ND	29	ND
	2Q07	>5700		100	340	ND	0.15	ND	5.9	33	ND
	2Q07D	>5700		100	350	ND	0.11	ND	6.4	32	ND
	3Q07	>5700		10	260	ND	ND	ND	14	ND	ND
	4Q07	FS		490	380	ND	0.41	0.43	10	ND	ND
	1Q08	>5700		140	360	ND	0.13	0.17	5.4	55	ND
	2Q08	>5700		200	330	ND	0.15	0.23	ND	130	ND
MW-27s	2Q06	NR	NS	5180	630	ND	0.26 J	4.8	43.3	20	ND
	3Q06	>5700	NS	3850	***798***	ND	ND	1.4	108	3.7 J	ND
	4Q06	>5700	NS	166	***753***	0.16	ND	0.82	116	2.3 J	ND
	1Q07	>5700		580	***650***	ND	ND	0.19	91	ND	ND
	2Q07	>5700		48	***640***	ND	ND	3.5	97	ND	ND
	3Q07	270		150	***630***	ND	ND	0.12	84	ND	ND
	4Q07	FS		260	***620***	0.16	0.45	ND	87	22	ND
	1Q08	>5700		850	***530***	0.65	ND	0.74	78	ND	ND
	2Q08	>5700		770	490	0.19	ND	0.91	67	ND	ND
MW-28s	2Q06	6	NS	35.2	350	ND	0.35 J	0.25	2.6 J	3100	ND
Dilution factor for Methane 200	3Q06	1,300	NS	22	460	ND	0.26 J	0.37	ND	3,200	ND
Dilution factor for Methane 200	3Q06D	1,500	NS	22	468	ND	ND	0.37	1.7J	3,100	ND
Dilution factor for Methane 100	4Q06	1	NS	25	347	ND	ND	0.43	2.0 J	4,400	ND
	1Q07	460		180	350	ND	ND	0.42	ND	170	ND
	1Q07D	230		93	360	ND	ND	0.43	ND	810	0.0051
Dilution factor for Methane 10	2Q07	78		49	400	ND	0.14	0.34	ND	1,600	ND
Dilution factor for Methane 4	3Q07	ND		50	350	ND	ND	0.34	ND	1,100	ND
Dillution for Methane is 40	4Q07	320		42	330	ND	0.19	0.38	ND	1,900	ND
	1Q08	80		31	250	ND	0.14	0.36	ND	570	ND
Dilution for Methane is 10	2Q08	11		44	360	ND	0.19	ND	ND	1,400	ND
MW-28i											
Dilution factor for Methane 10	2Q06	290	NS	28	367	0.047 J	ND	0.22	2.2 J	1900	ND
Dilution factor for Methane 100	3Q06	>5,700	NS	42.8	338	ND	ND	0.19	3.5 J	1500	ND
Dilution factor for Methane 100	4Q06	440	NS	15.6	335	ND	ND	0.22	3.0 J	1500	ND
	1Q07	110		34	380	0.1	0.2	0.35	ND	410	ND
Dilution factor for Methane 4	2Q07	24		23	330	ND	0.27	0.29	ND	710	ND
	3Q07	37		37	300	ND	0.28	0.27	ND	560	ND
	4Q07	160		34	360	ND	0.47	0.64	5.1	370	ND
	1Q08	ND		25	290	ND	0.37	0.29	ND	170	ND
Dilution factor for Methane 10	2Q08	17		38	560	ND	0.31	0.23	ND	870	ND
MW-29s	2Q06	250	NS	58.8	***504***	ND	11.9	0.45	4.0 J	1200	ND
Dilution factor for Methane 250	3Q06	>5700	NS	54	***546***	ND	9.9	0.32	1.9 J	5000	ND
Dilution factor for Methane 100	4Q06	190	NS	35.6	***509***	ND	8.3	0.29	3.9 J	5200	ND
	1Q07	30		41	***510***	0.14	7.5	0.34	ND	450	0.0084
Dilution factor for Methane 4	2Q07	150		56	490	ND	8.3	0.29	ND	1000	ND
Dilution factor for Methane 10	3Q07	1900		54	***520***	ND	8.1	0.4	ND	2500	ND
Dillution for Methane 10	4Q07	FS		66	500	ND	9.3	0.44	ND	3100	0.014
Dillution for Lead 5	1Q08	93		60	***510***	ND	7.5	0.34	ND	2000	ND
Dillution for Lead 5	1Q08D	120		38	***510***	ND	7.6	0.35	ND	1800	ND
Dilution for Methane 10	2Q08	65		40	490	ND	8.2	0.3	ND	2100	ND
MW-30s	2Q06	2200	NS	75.6	348	ND	0.86	0.17	5.2	3800	ND
Dilution factor for Methane 200	3Q06	>5700	NS	132	457	ND	0.89	0.32	ND	2500	ND
Dilution factor for Methane 100	4Q06	>5700	NS	147	448	ND	1.1	0.24	5.5	6500	ND
Dilution factor for Methane 10	2Q07	>5700		650	350	ND	0.94	1.6	ND	1800	ND
Dilution factor for Methane 4	3Q07	>5700		220	440	ND	1	0.34	ND	1700	ND
Dilution factor for Methane 4	3Q07D	>5700		180	400	ND	1.1	0.33	ND	1500	ND
Dilution factor for Methane 10	4Q07	>5700		120	***520***	ND	1.3	0.22	ND	1900	ND
Dilution factor for Methane 4	1Q08	1,100		2,300	410	ND	0.97	1.2	ND	1,300	ND
Dilution factor for Methane 10	2Q08	>5700		36	320	ND	0.93	0.26	ND	1,700	ND
MW-30i	2Q06	>5700	NS	18.8	369	ND	1.8	0.15	8.2	1100	ND
Dilution factor for Methane 100	3Q06	290	NS	41.6	414	ND	0.83	0.23	3.2 J	1200	ND
Dilution factor for Methane 50	4Q06	40	NS	17.2	456	ND	0.89	0.24	11.1	930	ND
Dilution factor for Methane 50	4Q06D	43	NS	41.2	478	ND	ND	0.23	11.1	930	ND
Dilution factor for Methane 4	2Q07	36		34	300	ND	0.8	0.31	ND	680	ND
	3Q07	ND		41	430	ND	1	0.33	ND	97	ND
	4Q07	470		69	***530***	ND	1.1	0.45	ND	ND	ND
	1Q08	2		33	410	ND	1.2	0.34	ND	370	ND
	2Q08	23		27	***540***	ND	1	ND	ND	510	ND
Dup 03	2Q08D	16		26	300	ND	1	0.29	ND	560	ND

TABLE 4 **Through 2nd Quarter 2008**

L.E.Carpenter and Company (LEC), Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Analytical Data

Well ID	Sampling Event	Heterotrophic Plate Count	Alkalinity to pH 4.5	TSS	TDS	Nitrate Nitrogen	Ammonia Nitrogen	Phosphorus (total)	Sulfate[1]	Methane	Dissolved Lead
	UNITS	cfu/ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
NEW JERSEY GROUNDWATER QUALITY STANDARDS CLASS IIA		NCS		NCS	500	NCS	NCS	NCS	250	NCS	.005[2]
MW-30d	2Q06	2800	NS	11.6	248	ND	0.30 J	ND	9.7	45	ND
	3Q06	>5700	NS	6.4 J	288	0.043 J	ND	ND	10.6	5.3	ND
	4Q06	47	NS	5.6 J	375	ND	ND	ND	12.5	22	ND
	2Q07	130		13	240	ND	0.11	ND	10	77	ND
	3Q07	78		9	260	ND	0.16	ND	11	ND	ND
	4Q07	FS		20	300	ND	0.24	0.11	11	ND	ND
	4Q07D	FS		20	270	ND	0.19	0.28	11	ND	ND
	1Q08	790		8	300	ND	0.12	ND	9.4	47	ND
	2Q08	420		12	370	ND	0.27	ND	5.3	140	ND
MW-31s											
Dilution factor for Ammonia and Methane 10	2Q08	>5700		460	***810***	0.12	22	0.68	44	3000	ND
MW-32s											
Dilution factor for Methane 10	2Q08	>5700		NS	***3400***	ND	2	14	8.6	4800	ND
MW-33s											
Dilution factor for Methane 10	2Q08	>5700		220	310	ND	5	0.17	8	2800	**0.011**
MW-34s											
Dilution factor for Methane 10	2Q08	>5700		NS	490	ND	ND	ND	12	3700	ND
MW-35s											
Dilution factor for Methane is 10	2Q08	>5700		2100	***570***	ND	1.8	ND	13	3900	ND
GEI-2S	3Q07	66		8.0	460	2.2	ND	ND	25	490	ND
	2Q08	57		6.7	***650***	1.9	ND	ND	34	ND	ND
Atmospheric Blank	1Q05	> 5700	ND	ND	ND	ND	ND	ND	ND	ND	NS
	4Q05	5	NS	ND	10.0 J	ND	ND	ND	0.30 J	ND	NS
	1Q06	2	NS	ND	ND	ND	ND	ND	ND	ND	NS
	2Q06	38	NS	ND	ND	ND	ND	ND	1.5 J	ND	ND*
	3Q06	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	4Q06	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	1Q07	1		ND	ND	ND	ND	ND	ND	22	ND*
	2Q07	ND		ND	19	ND	ND	ND	ND	ND	ND*
	3Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	4Q07	ND		ND	ND	ND	0.16	ND	ND	ND	ND*
	1Q08	ND		ND	ND	ND	0.16	ND	ND	ND	ND*
	2Q08	ND		ND	ND	ND	ND	ND	ND	ND	0.0051*
Rinsate Blank	1Q05	36	ND	ND	ND	ND	ND	ND	ND	ND	NS
	3Q05	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS
	4Q05	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS
	1Q06	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS
	2Q06	120	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	2Q06	250	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	3Q06	45	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	3Q06	84	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	4Q06	56	NS	ND	ND	ND	ND	ND	ND	ND	ND*
	1Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	1Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	2Q07	1		ND	2.5	ND	ND	ND	ND	ND	ND*
	2Q07	2		ND	ND	ND	ND	ND	ND	ND	ND*
	3Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	3Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	4Q07	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	4Q07	ND		ND	11	0.17	ND	ND	ND	ND	ND*
	1Q08	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	1Q08	ND		ND	ND	ND	ND	0.15	ND	ND	ND*
	2Q08	ND		ND	ND	ND	ND	ND	ND	ND	ND*
	2Q08	ND		ND	ND	ND	ND	ND	ND	ND	ND*

Notes:
As mentioned in January 13, 2005 letter, only the MW-19 Hotspot wells will be sampled for MNA parameters due to the implementation of Source Reduction on the L.E. Carpenter property effective 1Q05.
(1) Sulfate results reported through 4Q06 have a dilution factor of 5, except for blank samples or unless otherwise noted. Starting 1Q07, there is no dilution factor for sulfate unless noted otherwise.
(2) NJ CLASS IIA GWQC, NJ SWQC [FW2] and PQL are for Total Lead
NCS: No Criteria Specified by NJDEP
NS = Not Sampled
FS= Samples frozen in transit to lab.
ND = Not Detected
[L] Lower Grab Sample
[U] Upper Grab Sample
Concentration exceeds NJGWQS **1.2**
* Total Lead

Table 5 **Through 2nd Quarter 2008**

L.E.Carpenter and Company, Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Field Data

Well ID	Event	DO (mg/L)	pH	ORP (mV)	Conductivity (uS/cm)	Turbidity (NTU)	Temperature (°C)	Ferrous Iron (ppm)	Alkalinity (ppm)	CO2 (mg/L)
MW-19	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	10.97	7.23	24	890	2	13.94	NM	160	70
	3Q04	0.1	7.62	-10	1179	2	16.18	<10	200	95
	1Q05	0.2	7.67	100	590	5	11.82	9	241(1)	121
	2Q05L	1	7.84	NM	734	10	8.6	0.3	30	<10
	2Q05U	1	7.69	NM	760	10	8.46	0.4	29	<10
	3Q05	1	7.03	185	1920	9	15.86	>10	110	60
	4Q05	5.34	6.47	87	1005	4	15.01	>10	110	18
	1Q06	3.53	6.59	-50	978	13	8.72	>10	11	>100
	2Q06	4.92	7.66	-43	905	9	13.98	>10	225	60
	3Q06	0.34	7.08	-24	761	5	16.2	18	100	90
	4Q06	0.08	6.53	-76.7	579	7	15.36	>10	275	70
	1Q07	0.15	6.59	-90.3	444	5	10.38	20	250	35
	2Q07	0.05	6.69	-56	1640	2.5	13.7	>20	100	120
	3Q07	0.1	6.59	-94	1201	2	17.05	>20	200	80
	4Q07	0.2	6.36	5	865	5.1	12.54	>20	225	40
	1Q08	0.6	6.4	111.7	214.2	5	8.55	0.1	40	14
	2Q08	0.22	6.12	68.4	1,068	6.66	10.55	>10	125	130
MW-19-1	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	13.9	7.22	180	1373	10	13.9	NM	125	17
	3Q04	1	7.50	80	1910	10	18.49	0.2	90	28
	1Q05	1	7.80	213	676	10	11.49	0	152(1)	30
	2Q05L	0.8	7.60	NM	2540	22	9.15	0.2	75	<10
	2Q05U	1	7.67	NM	2540	10	8.5	0.1	90	<10
	3Q05	1	7.22	208	2260	20	15.23	0.1	100	10
	4Q05	6.54	7.06	291	1149	36	16.70	0.1	45	<10
MW-19-2	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	4.45	7.30	83	1199	6	13.97	NM	210	60
	3Q04	5	7.45	59	1830	9	16.97	2	130	15.5
	1Q05	1	7.30	249	825	10	11.02	0	395(1)	63
	2Q05L	0.8	7.80	NM	1312	29	7.76	0.1	100	<10
	2Q05U	0.8	7.76	NM	1316	10	8.00	0.1	100	10
	3Q05	1	7.59	204	1980	3	14.87	1	100	10
	4Q05	4.75	6.79	290	1442	1	16.50	0.2	105	15.5
MW-19-4	1Q06	7.62	7.53	-64	1351	14	5.61	0.6	12	>50
	2Q06	6.53	7.74	116	1442	22	13.93	0.2	100	17
	3Q06	2.93	7.43	92	1335	9	18.68	0	10	19
	4Q06	4.03	7.69	172	886	10	16.67	0	150	22
	1Q07	2.01	6.95	105	418	17	11.71	0	125	11
	2Q07	0.8	6.74	-1	1800	7.8	14.59	0.1	75	16
	3Q07	0.4	7.16	45	1187	10	17.68	0.05	125	26
	4Q07	0.6	7.57	216	1385	6	12.58	0	50	20
	1Q08	4	7.02	73.1	938.5	9	7.98	0	100	13
	2Q08	4.13	6.52	113	987	8.33	11.22	0.1	100	15
MW-19-5	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	10.16	7.02	41	1550	4	12.89	NM	130	70
	3Q04	1	7.26	87	1740	19	16.3	2	150	60
	1Q05	1	7.94	226	269	9	10.59	0	126(1)	63
	2Q05L	1	7.94	NM	2640	10	8	0	45	16
	2Q05U	0.8	7.99	NM	2100	38	6.96	0	45	10.5
	3Q05	0.8	7.44	184	920	2	15.15	>10	100	35
	4Q05	1.84	6.27	217	216	10	15.15	0.1	30	11
	1Q06	3.35	6.35	249	512	3	8.17	0	12	>100
	2Q06	6.79	7.50	36	327	5	14.4	0.3	90	27
	3Q06	2.87	7.45	143	406	10	16.38	0	100	22
	4Q06	6.3	7.55	184	347	6	14.49	0.4	145	32
	1Q07	0.16	6.53	14.2	370	4	10.08	1	175	16
	2Q07	0	7.04	-36	539	6.8	14	>20	190	70
	3Q07	0.1	7.09	36	530	5	16.18	1	160	65
	4Q07	1.6	6.17	45	311	3.6	12.59	0.4	130	30
	1Q08	1.83	6.28	108.1	125.5	12	6.14	0.1	35	15
	2Q08	1.48	5.99	6	371	10	10.06	0.2	100	40
MW-19-6	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	5.48	6.86	56	2640	10	15.24	NM	80	33
	3Q04	1	7.43	83	2490	4	16.61	0.4	125	20
	1Q05	1	7.73	241	867	12	11.79	0	204(1)	41
	2Q05L	1	7.50	NM	1870	27	10.64	0.1	75	15
	2Q05U	1	7.48	NM	1790	2	9.89	1	80	20
	3Q05	1	7.28	191	3030	36	15.2	0.4	70	20
	4Q05	5.39	5.86	307	1550	9	14.76	0	80	10.5
	1Q06	3.71	6.60	237	1116	4	9.93	0	12	>100
	2Q06	6.61	7.53	35	1520	5	13.51	0.2	125	23
	3Q06	4.48	7.44	162	1249	9	16.11	0	100	24

Table 5
L.E.Carpenter and Company, Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Field Data

Well ID	Event	DO (mg/L)	pH	ORP (mV)	Conductivity (uS/cm)	Turbidity (NTU)	Temperature (°C)	Ferrous Iron (ppm)	Alkalinity (ppm)	CO2 (mg/L)
	4Q06	4.7	7.47	207	941	8	15.45	0	70	40
	1Q07	1.16	6.82	69.5	602	8	11.38	0.2	90	16
	2Q07	1	6.69	-35	2720	5.6	14.36	0.1	140	50
	3Q07	0.8	7.16	12	1458	4	17.3	0.6	160	42
	4Q07	2	7.44	51.4	1283	5.9	12.92	0.3	25	17
	1Q08	1	6.52	91.2	854.4	6	10.71	0.4	100	20
	2Q08	3.69	6.71	119.4	1,205	2.4	11.83	0.6	110	35
MW-19-7	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	5.89	6.82	48	380	6	14.34	NM	95	90
	3Q04	1	6.92	113	4040	2	16.77	1	75	70
	1Q05	0.6	7.16	281	1388	1	11.34	3	200(1)	63
	2Q05L	0.05	7.82	102	938	25	11.7	15	160	36
	2Q05U	1	7.80	NM	961	49	11.22	15	200	29
	3Q05L	0.8	7.03	90	2670	17	14.76	>10	95	0.8
	3Q05U	1	7.02	185	2460	5	16.02	>10	70	35
	4Q05	1.58	5.98	-44	1434	14	14.85	>10	11	30
	1Q06	1.86	6.20	43	1130	14	10.81	>10	>100	>100
	2Q06	3.87	7.41	-33	1284	9	13.28	>10	170	70
	3Q06	0.6	7.28	33	1254	10	15.8	9	200	50
	4Q06	0.44	7.47	204	970	7	15.23	2	185	70
	1Q07	0.12	6.80	-84.3	518	6	11.52	9	175	23
	2Q07	0	6.98	36	1397	4.5	15.68	2	100	38
	3Q07	0.2	7.05	181	1016	5	17.48	0.2	120	38
	4Q07	0.6	6.48	74.2	2126	5.3	12.7	0.2	70	30
	1Q08	1	6.21	105.4	2023	10	9.48	0.3	45	27
	2Q08	0.24	6.42	0.5	1,892	9.13	11.31	1.5	130	22.5
MW-19-8	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	3.98	6.9	-24	2010	10	15.69	NM	125	30
	3Q04	0.4	7.52	48	1093	7	18.29	2	100	19
	1Q05	0.3	7.06	161	177	16	12.92	10	142(1)	28
	2Q05	0.8	7.92	NM	1510	47	10.82	6	70	19
	3Q05	0	7.07	147	1820	2	18.86	3	80	19
	4Q05	6.74	6.10	330	1460	5	17.19	3	85	20
MW-19-9D	1Q04	NS	NS	NS	NS	NS	NS	**	**	**
	2Q04	3.03	7.11	-28	480	63	14.64	**	**	**
	3Q04	0.2	7.40	8	545	35	15.7	**	**	**
	1Q05	1.5	7.14	193	871	267	11.58	**	**	**
	2Q05	0.05	7.91	NM	471	70	12.12	**	**	**
	3Q05	0	7.35	189	552	2	16.4	**	**	**
	4Q05	0.94	5.78	-91	465	1	13.96	**	**	**
MW-19-10	1Q04	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2Q04	3.82	6.78	85	1050	7	13.94	NM	80	25
	3Q04	0.1	7.35	107	1498	11	15.56	1.5	65	20
	1Q05	0.15	7.25	285	1039	28	13.19	2	127(1)	20
	2Q05L	0.8	7.47	NM	1209	52	12.18	0.4	70	13
	2Q05U	1	7.48	NM	1282	41	11.18	1	75	13
	3Q05	1	7.62	212	1148	18	16.47	0.6	70	13
	4Q05	9.89	6.73	229	1167	39	15.00	1	60	10
MW-19-11	1Q05	1.5	7.01	215	740	8	10.3	0	205(1)	65
	2Q05L	0.8	7.88	NM	1424	38	12.18	4	110	17
	2Q05U	0.8	7.80	NM	1442	10	12.12	4	90	15
	3Q05	1	7.72	209	1155	77	16.63	1	80	12.5
	4Q05	2.5	6.51	271	1470	10	15.86	0.4	85	15
MW-19-12	2Q06	0.99	7.29	-33	1046	9	16.06	4	120	100
	3Q06	0.21	7.41	5	1460	18	17.9	4	12	17
	4Q06	0.23	7.60	191	1234	10	16.72	3.5	1000	17
	1Q07	0.18	6.91	-39.6	680	8	12.29	1.5	100	10
	2Q07	2	7.24	137	473	5	18.56	0	110	11
	3Q07	2	7.45	118	463	2	19.2	0	85	0
	4Q07	9	7.55	2.7	439	8.1	9.68	0	110	<10
	1Q08	2	6.72	78.4	197.2	2	7.59	0	40	<10
	2Q08	7.4	7.09	79	386	0.12	13.31	0	110	<10

Table 5
L.E.Carpenter and Company, Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Field Data

Well ID	Event	DO (mg/L)	pH	ORP (mV)	Conductivity (uS/cm)	Turbidity (NTU)	Temperature (°C)	Ferrous Iron (ppm)	Alkalinity (ppm)	CO2 (mg/L)
MW-25R	2Q06	0.47	6.77	-102	620	9	14.74	3.5	75	17
	3Q06	0.97	5.57	90.1	572	229	15.67	5	160	350
	4Q06	0.25	7.14	-41.2	517	24	11.33	1.5	90	100
	1Q07	1.8	6.80	-100.4	636	55	7.15	3	100	150
	2Q07	0.35	6.69	-65.8	453	123	14.38	3.5	40	20
	3Q07	1	6.98	-75.3	355	NM-mtr broke	18.93	0.3	75	15
	4Q07	0.6	7.15	30	616	127	6.81	2	100	110
	1Q08	0.34	7.32	-79	639	47.6	7.87	4.5	150	12.5
	2Q08	0.21	7.20	-80	601	46	10.95	4.5	150	15
MW-27s	2Q06*	1.66	7.74	183	933	>1000	16.65	0	80	<10
	3Q06	0.54	7.72	45	1437	247	19.44	0	200	14
	4Q06	2.36	7.59	134	1275	>1000	16.39	0	<10	20
	1Q07	4	7.15	-10.8	1078	>1000	8.31	NM - sediment	NM - sediment	NM - sediment
	2Q07	8.29	7.09	105.6	765	>1000	15.23	NM - sediment	NM - sediment	NM - sediment
	3Q07	0.4	7.24	27	1017	>1000	17.58	NM - sediment	NM - sediment	NM - sediment
	4Q07	1	7.16	165	1002	997	11.34	NM - sediment	NM - sediment	NM - sediment
	1Q08	1	7.15	71.5	612.7	186	8.41	NM - sediment	NM - sediment	NM - sediment
	2Q08	1	7.18	111.1	735	81.1	11.43	0	22.5	85
MW-28s	2Q06	0.11	7.69	-478	687	12	14.38	>10	82	37
	3Q06	0.27	5.96	-101.8	831	14	17.69	>20	180	90
	4Q06	0.04	7.22	-146.8	684	20	15.27	>20	200	55
	1Q07	2.1	6.74	-176.2	650	12	9.75	>20	160	22
	2Q07	0.48	7.01	-138.3	568	36	15.36	>20	180	35
	3Q07	0.1	7.1	-132.1	576	9.6	16.99	>20	180	50
	4Q07	0.2	6.86	-120.4	634	7.03	11.97	>20	170	22
	1Q08	0.11	7.3	-169	492	11.3	9.22	15	130	20
	2Q08	0.19	6.57	-52.4	508	9.13	12.25	>10	140	35
MW-28i	2Q06	0.23	7.88	-126	756	8	15	>10	135	28
	3Q06	0.51	7.59	-98	649	14	16.42	18	90	27
	4Q06	0.04	7.37	-146.7	598	13	14.82	>20	150	25
	1Q07	0.2	6.80	-173.3	686	4.9	10.7	>20	140	23
	2Q07	0.18	7.07	-170	507	17	14.9	>20	145	24
	3Q07	0.1	7.15	-104.7	536	5.7	16.19	>20	170	30
	4Q07	0.26	6.59	-58.2	677	7.44	11.96	>20	160	20
	1Q08	0.01	6.81	-100.2	400.2	6	10.31	12	135	20
	2Q08	0.2	6.65	-4.8	593	7.75	12.99	>10	170	35
MW-29s	2Q06	3.63	7.32	-32	1021	68	18.45	>10	260	95
	3Q06	0.36	6.73	-109.8	1090	10	20.63	18	310	80
	4Q06	0.05	6.85	-97.9	775	11	17.04	>10	350	65
	1Q07	0.7	6.53	-163.9	902	5.6	8.77	18	240	30
	2Q07	4.03	6.71	-113.8	766	31	18.48	>10	225	25
	3Q07	0.7	6.66	-13.9	881	9.84	21.12	>20	325	100
	4Q07	0.2	7.12	-35	960	8	13.51	>20	285	75
	1Q08	0.21	7.02	-94	1027	9.92	7.87	>10	290	22
	2Q08	0.27	6.89	31.2	935	5.9	12.22	>20	250	70
MW-30s	2Q06	0.14	6.76	-180	672	34	16.81	>10	78	14
	3Q06	0.39	5.66	73.1	704	155	18.9	18	60	250
	4Q06	0.01	7.09	-146.1	627	94	13.46	>20	200	60
	1Q07	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen
	2Q07	0.34	6.99	-159.4	458	213	18.55	>20	225	40
	3Q07	0.3	7.05	-128.7	696	100	19.15	>20	230	37
	4Q07	0.8	7.45	-50	871	67	7.74	>20	200	43
	1Q08	0.12	7.32	-158	825	113	4.85	>20	NM - sediment	NM - sediment
	2Q08	0.2	7.49	-47.6	484	9.42	11.43	18	160	22.5
MW-30i	2Q06	0.33	7.70	-194	687	8	15.22	5.5	75	19
	3Q06	0.43	7.52	-63	777	9	17.13	18	180	32
	4Q06	0.2	7.16	-144.2	827	42	14.2	>10	>1000	45
	1Q07	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen
	2Q07	0.33	6.99	-146.8	486	41	15.23	>20	145	25
	3Q07	0.4	7.08	-19.8	661	NM-mtr broke	17.07	>20	200	29
	4Q07	1	7.39	-15	889	136	8.28	>20	200	24
	1Q08	0.13	6.7	-149	784	9.98	8.55	>20	150	18
	2Q08	0.08	7.29	-142	581	21	12.28	16	140	26
MW-30d	2Q06	0.3	5.35	-131	449	10	14.45	2	100	30
	3Q06	2.49	7	-44	458	15	15.07	2.5	70	70
	4Q06	0.18	7.29	-99	637	33	13.39	5	130	17
	1Q07	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen	NS-frozen
	2Q07	0.38	7.03	-95.7	340	69	14.51	3.5	115	12
	3Q07	0.8	7.24	22.6	401	NM-mtr broke	14.73	3	130	13
	4Q07	0.1	7.05	128	500	80	10.02	0.4	100	<10
	1Q08	0.45	6.8	1	487	16.3	9.19	1.5	130	<10
	2Q08	0.32	7.24	-62	504	18	12.87	2	125	14

Table 5
L.E.Carpenter and Company, Borough of Wharton, Morris County, New Jersey
Quarterly Groundwater Monitoring
MNA Field Data

Well ID	Event	DO (mg/L)	pH	ORP (mV)	Conductivity (uS/cm)	Turbidity (NTU)	Temperature (^{o}C)	Ferrous Iron (ppm)	Alkalinity (ppm)	CO2 (mg/L)
MW-31s	2Q08	0.51	12.47	-192	1,499	>1000	15.74	1	225	0
MW-32s	2Q08	0.33	6.9	-86	1,105	109	12.11	NM-No Water	NM-No Water	NM-No Water
MW-33s	2Q08	0.77	7.29	-74	650	682	12.98	18	180	70
MW-34s	2Q08	0.51	7.01	-111	794	7	14.84	NM-No Water	NM-No Water	NM-No Water
MW-35s	2Q08	0.37	6.78	-56	917	>1000	11.51	>20	310	70
GEI-2S	3Q07	0.6	6.47	-29.8	586	15	15.28	0	150	30
	2Q08	3.71	6.29	118.4	669	7.5	9.97	0	50	17

Notes:

As mentioned in January 13, 2005 letter, only the MW-19 Hotspot wells will be sampled for MNA parameters due to the implementation of Source Reduction on the L.E. Carpenter property effective 1Q05.

** Additional field MNA parameters not required for MW-19-9D.

(1) Laboratory analyzed for alkalinity due to destroyed field kits.

NS = Not Sampled

NM = Not Measured

L Lower Grab Sample

U Upper Grab Sample

* Well was not stabalized due to well going dry.

Table 6
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Surface Water Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS											
	SAMPLE DATE	QUARTER	Benzene		Ethylbenzene		Toluene		Total Xylenes		bis-2-Ethylhexylphthalate (DEHP)	
		UNITS	ug/l		ug/l		ug/l		ug/l		ug/l	
		APPLICABLE BACKGROUND CONCENTRATION (SW-R-5) CONCENTRATION AT OR BELOW DECTION LIMIT N.J.A.C. 7:9B-1.5 (d)6iii	1		1		5		3		1.2	
SW-D-1												
*	8-Apr-05	2Q05	<	0.2	<	0.20	<	0.20	<	0.60	<	1.00
	26-Jul-05	3Q05	<	0.2	<	0.2	J	0.5	<	0.6	<	1.0
	26-Oct-05	4Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	27-Feb-06	1Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***2.0***
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	J	0.2	<	0.6	J	***11.0***
	9-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	7-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***7.3***
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.18	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0		***4.9***	<	1.2
Dilution factor for DEHP 1.03	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
SW-D-2												
	8-Apr-05	2Q05		NS		NS		NS		NS		NS
	26-Jul-05	3Q05	<	0.2	J	0.5	<	0.2		***6.1***		***38.0***
	26-Oct-05	4Q05	<	0.2	J	0.6	<	0.2	J	2.0	<	1.0
	27-Feb-06	1Q06	<	0.2	J	0.8	<	0.2	J	2.7		***27.0***
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	1.0
	19-Jun-06	2Q06D	<	0.2	<	0.2	<	0.2	<	0.6	J	***2.0***
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***2.0***
	9-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	1.0
	7-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0		***11.0***
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***3.0***
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0		***1.5***
Dilution factor for DEHP 1.11	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0		***4.4***	<	1.1
Dilution factor for DEHP 1.18	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
SW-D-3												
	8-Apr-05	2Q05	<	0.2		***21.0***	<	0.2		***79.0***	J	***2.0***
	26-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	J	1.1	J	***7.0***
	26-Oct-05	4Q05	<	0.2	J	0.4	<	0.2	J	1.4	<	1.0
	27-Feb-06	1Q06	<	0.2		***1.1***	<	0.2		***3.9***	J	***6.0***
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***3.0***
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	1.0
	11-Sep-06	3Q06D	<	0.2	<	0.2	<	0.2	<	0.6	J	***3.0***
	9-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	7-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0		***3.3***
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***1.6***
Dilution factor for DEHP 1.1	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.05	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0		***3.8***	<	1.0
DUP-01	18-Feb-08	1Q08Dup	<	1.0	<	1.0	<	5.0		***3.8***	<	1.0
Dilution factor for DEHP 1.25	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
SW-D-4												
	20-Jun-06	2Q06	<	0.2	<	0.2	J	0.4	<	0.6	J	***3.0***
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***2.0***
	9-Nov-06	4Q06	<	0.2	J	0.4	<	0.2	J	0.6	<	0.9
	7-Feb-07	1Q07	<	1.0		***2.0***	<	5.0		***3.8***		***3.3***
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		1.0
	4-Dec-07	4Q07	<	1.0		***1.4***	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.08	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0		***4.1***	<	1.1
Dilution factor for DEHP 1.08	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
SW-D-5												
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***10.0***
	6-Nov-06	4Q06	<	0.2	J	0.2	<	0.2	J	0.8	<	0.9
	7-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***3.4***
	3-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.1	3-Dec-07	4Q07D	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.03	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.25	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
DRC-2												

Table 6
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Surface Water Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS											
	SAMPLE DATE	QUARTER	Benzene		Ethylbenzene		Toluene		Total Xylenes		bis-2-Ethylhexylphthalate (DEHP)	
		UNITS	ug/l		ug/l		ug/l		ug/l		ug/l	
	APPLICABLE BACKGROUND CONCENTRATION (SW-R-5) CONCENTRATION AT OR BELOW DECTION LIMIT N.J.A.C. 7:9B-1.5 (d)6iii		1		1		5		3		1.2	
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	6-Nov-06	4Q06	<	0.2	J	0.5	<	0.2	J	1.9	<	0.9
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	3-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.18	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
SW-R-1												
	20-Apr-05[(1)]	2Q05	<	0.2		***17.0***	J	0.8		***99.0***	J	***2.0***
	25-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	<	0.6	J	1.0
	27-Oct-05	4Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	27-Feb-06	1Q06	<	0.2	J	0.3	<	0.2	J	1.4	<	0.9
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	6-Nov-06	4Q06	<	0.2	J	0.2	<	0.2	J	1.1	<	1.0
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***1.3***
	3-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.11	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.18	5-May-08	2Q08	<	1.0		***1.2***	<	5.0		***5.9***	<	1.2
SW-R-2												
	20-Apr-05	2Q05		NS		NS		NS		NS		NS
	25-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	27-Oct-05	4Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	27-Feb-06	1Q06	<	0.2	J	0.5	<	0.2	J	2.3	<	1.0
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	6-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Nov-06	4Q06D	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***1.7***
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.11	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.14	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
SW-R-3												
	20-Apr-05	2Q05		NS		NS		NS		NS		NS
	25-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	27-Feb-06	1Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	J	***2.0***
	6-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0		***3.0***
	25-Jun-07	2Q07D	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***3.9***
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.11	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.05	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.25	5-May-08	2Q08D	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
SW-R-4												
	20-Apr-05	2Q05		NS		NS		NS		NS		NS
	25-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	27-Feb-06	1Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	6-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0		***19.0***
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.11	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
SW-R-5												
	20-Apr-05	2Q05		NS		NS		NS		NS		NS
	25-Jul-05	3Q05	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9

Table 6
L.E. CARPENTER AND COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Surface Water Monitoring Data

MONITORING WELLS	ANALYTICAL PARAMETERS											
	SAMPLE DATE	QUARTER	Benzene		Ethylbenzene		Toluene		Total Xylenes		bis-2-Ethylhexylphthalate (DEHP)	
UNITS			ug/l		ug/l		ug/l		ug/l		ug/l	
APPLICABLE BACKGROUND CONCENTRATION (SW-R-5) CONCENTRATION AT OR BELOW DECTION LIMIT N.J.A.C. 7:9B-1.5 (d)6iii			1		1		5		3		1.2	
	27-Feb-06	1Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	7-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07D	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.18	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.2
SW-R-6												
	27-Feb-06	1Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	19-Jun-06	2Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	1.0
	11-Sep-06	3Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Nov-06	4Q06	<	0.2	<	0.2	<	0.2	<	0.6	<	0.9
	6-Feb-07	1Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	25-Jun-07	2Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	10-Sep-07	3Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
	4-Dec-07	4Q07	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
Dilution factor for DEHP 1.14	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
Dilution factor for DEHP 1.11	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.1
RINSE BLANK												
RB-01	18-Feb-08	1Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0
RB-01	5-May-08	2Q08	<	1.0	<	1.0	<	5.0	<	3.0	<	1.0

LEGEND

ug/L = micrograms per liter
NCS: No Criteria Specified
NS = Not Sampled
duplicate = Duplicate sample

Surface Water Quality Standard Reference: N.J.A.C 7:9B October 2006.
(Dover) - Washington Pond outlet downstream to Rt. 46 bridge Cat 1 FW2-TM(C1)

Concentration exceeds NJSWQS — ***38.0***

B: Analyte also detected in blank
J: Estimated value. Value is greater than or equal to the Method Detection Limit (MDL) and less than the Limit of Quantitation (LOQ)
* = Detection limit is elevated due to interference from other parameter detections. Laboratory will be contacted to lower benzene detection limit to be below the NJSWQS.

(1) One surface water sample was collected near the edge of the river immediately adjacent to the location of absorbent booms that were placed in order to prevent any migration into the river of sheen observed on top of quiescent water ponded within the w

TABLE 7
L.E. CARPENTER & COMPANY (LEC) - Borough of Wharton, Morris County, New Jersey
Sampling Summary Table

Area of Concern	Sample Locations	Medium	Sample Depth	Parameters	Method
Remaining Source(s) Area					
	TG01 through TG15	LNAPL in soil & groundwater	Surface to Non-Detect	LNAPL by TarGOST®	Geoprobe and TarGOST®
	3 Selected locations	Soil	1 Peak & 1 NonDetect TarGOST® Response	LNAPL by hydrophobic dye	Geoprobe soil sample
	3 Selected locations	Soil	1 Peak & 1 NonDetect TarGOST® Response	BTEX and DEHP	Geoprobe soil sample
	Up to 4 representative samples	Soil	Representative samples from permeable soil units	Total chromium and TOC	Geoprobe soil sample
Groundwater					
	Routine quarterly sampling	Groundwater	Existing PRMP Wells	BTEX and DEHP, MNA parameters, and TOC	Low flow sampling methods (existing routine methods)
	MW36S	Groundwater	Water table	BTEX and DEHP, MNA parameters, and TOC	Low flow sampling methods (existing routine methods)
Groundwater Enhanced Bioremedation Pilot Study					
	Air Sparge wells	Injected air	Below depth of COCs	Air injection rate and pressure	
	Observation wells Frequency = twice before startup Weekly for 4 weeks after startup Every other week until completion	Groundwater	Water table	*Field:* DO, pH, ORP, conductivity, turbidity, temperature, ferrous iron, alkalinity, and CO2 *Laboratory*: BTEX, and DEHP, heterotrophic plate count, TSS, TDS, nitrate nitrogen, NH4, total phosphorus, sulfate, methane, and TOC	Low flow sampling methods (existing routine methods)

Figures

Appendix A
Report Certification

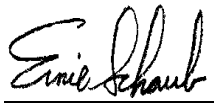
REPORT CERTIFICATION
PURSUANT TO N.J.A.C. 7:26E–1.5

"I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, to the best of my knowledge, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement, which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."

Ernie Schaub
PRINTED NAME

Manager, Environmental Services
TITLE

L.E. Carpenter & Company
COMPANY



SIGNATURE

21 August 2008
DATE

Appendix B
Agency Correspondence

EPA and NJDEP September 14, 2007 RAR Approval Letter

State of New Jersey

Jon S. Corzine
Governor

Department of Environmental Protection

Lisa P. Jackson
Commissioner

Bureau of Case Management
401 East State Street
P.O. Box 028
Trenton, NJ 08625-0028
Phone #: 609-633-1455
Fax #: 609-633-1439

September 14, 2007

LE Carpenter
33587 Walker Rd
Avon Lake, OH 44012

Remedial Action Report Approval

Re: Remedial Action Report
Response to NJDEP comments dated June 14, 2006
L E Carpenter
170 North Main St
Wharton, NJ 07885
SRP PI# 003017
EA ID #: SUB070006

Dear Mr. Anderson:

The New Jersey Department of Environmental Protection (Department) and the United States Environmental Protection Agency (USEPA) has completed its review of the Remedial Action Report (Response to NJDEP comments dated June 14, 2006) received on August 29, 2006. The Department and USEPA have determined that the Remedial Action Report is in compliance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E and other applicable requirements. The Department hereby approves the Remedial Action Report, effective the date of this letter.

Thank you for your cooperation in this matter. If you have any questions, call me at (609) 633-0835.

Sincerely,

Glenn R Savary, Case Manager
Bureau of Case Management

cc: Nick Clevett, RMT
Michelle Granger, EPA
George Blyskun, BGWPA
John Prendergast, BEERA
Health Officer, Wharton
Clerk, Wharton

EPA Explanation of Significant Difference

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

OCT 24 2007

Mr. Glenn Savary, Case Manager
New Jersey Department of Environmental Protection
Bureau of Case Management
CN 028
Trenton, New Jersey 08625

RE: Dayco Corporation/L.E. Carpenter Site. Superfund Site - Explanation of Significant Differences

Dear Mr. Savary:

Enclosed, for your information, please find The United States Environmental Protection Agency's (EPA's) Explanation of Significant Differences (ESD) for the Dayco Corporation/L. E. Carpenter Superfund (L. E. Carpenter site or Site) Site, located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey, dated September 27, 2007.

EPA issues this ESD in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation & Liability Act of 1980 (CERCLA), as amended, 42 U.S. C Section 9617 (c), and section 300.435 (c) (2) (i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C. F. R. Section 300.435 (c) (2) (i). The NJDEP concurred on this ESD through correspondence dated September 26, 2007.

Should you have any questions or need any additional information, please feel free to contact me at (212) 637-4975.

Sincerely yours,

Michelle Granger, Remedial Project Manager
Southern New Jersey Remediation Section

Enclosure

cc: Chris Anderson, PolyOne Corporation
Nick Clevett, RMT, Senior Project Manager
Jim Dexter, RMT
Jon Rheinhardt, Borough of Wharton

EXPLANATION OF SIGNIFICANT DIFFERENCES

DAYCO CORPORATION/L.E. CARPENTER SITE

Site Name and Location

Dayco Corporation/L.E. Carpenter Company
Wharton Borough
Morris County, New Jersey

Introduction

The purpose of this Explanation of Significant Differences (ESD) is to explain the changes made by the New Jersey Department of Environmental Protection (NJDEP) and United States Environmental Protection Agency (EPA) to the remedy selected in the April 1994 Record of Decision (ROD) for the Dayco Corporation/L.E. Carpenter Company Superfund Site (L.E. Carpenter site or Site).

EPA issues this ESD in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation & Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. §9617(c), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. §300.435(c)(2)(i). The NJDEP concurred on this ESD through correspondence dated September 26, 2007.

The ESD and documents that provide the basis of the ESD decision will be incorporated into the Administrative Record for the Site in accordance with Section 300.825(a)(2) of the NCP. The Administrative Record is available for review during business hours at EPA Region 2, 290 Broadway, New York, NY 10007 and at the information repository in the NJDEP Offices in Trenton, New Jersey.

Summary of Site History, Contamination Problems, and Selected Remedy

The L.E. Carpenter site is located at 170 North Main Street, Borough of Wharton, Morris County, New Jersey. The Site occupies approximately 14.6 acres, and is located northwest of the intersection of the Rockaway River and North Main Street.

The L.E. Carpenter site includes buildings, warehouses, and remnants of disposal areas that are associated with a former

vinyl wall covering manufacturing facility in Wharton Township. L.E. Carpenter manufactured vinyl wall coverings from 1943 to 1987. The manufacturing process involved the generation of various solid and liquid waste streams which were disposed of in unlined on-site lagoons.

NJDEP conducted soil and groundwater sampling in 1980 and 1981. Sampling results indicated the presence of volatile organic compounds, base neutral compounds, metals, and PCBs. In addition, NJDEP observed immiscible chemical compounds floating on the groundwater table.

In response to the findings of these sampling efforts, in 1982, L.E. Carpenter and NJDEP entered into an Administrative Consent Order (ACO) in which L.E. Carpenter agreed to delineate and remove soil and groundwater contamination at the Site.

Pursuant to the 1982 ACO, L.E. Carpenter installed a groundwater monitoring system, constructed a floating product recovery system, and excavated approximately 4,000 cubic yards of sludge and contaminated soils from the former on-site lagoons. In addition, as part of NJDEP cleanup activities, L.E. Carpenter removed sixteen above ground storage tanks and associated contaminated soils.

The National Priorities List (NPL) is a list of sites eligible for long-term remedial evaluation and response under EPA's Superfund program. The Site was added to the NPL in April 1985. The Site is a state-lead site.

In September 1986, NJDEP and L.E. Carpenter entered into an Amended ACO which superseded the previous ACO. In accordance with the September 1986 ACO, L.E. Carpenter, the Potentially Responsible Party (PRP), began a site-wide remedial investigation to determine the nature and extent of contamination. The Remedial Investigation (RI) was conducted in several phases and completed in 1992. In 1993, a Feasibility Study (FS) was conducted to evaluate possible cleanup actions. NJDEP issued a ROD, with EPA concurrence, on April 18, 1994. The major components of the ROD are:

1. Installation and operation of a floating product/groundwater extraction system;
2. Installation and operation of a groundwater pump and treat system, with a portion of the treated groundwater

to be recirculated within a capture zone, another portion to be discharged into a deeper aquifer in accordance with groundwater discharge criteria, and another portion to be treated via biological treatment;

3. Excavation and consolidation of bis (2-ethlyhexyl) phthalate (DEHP) contaminated soils into a soil treatment zone;
4. Reinfiltration of a portion of treated groundwater (with added oxygen and nutrients) into the unsaturated soil treatment zone via perforated piping to allow in-situ bioremediation of contaminated soils;
5. Installation of a vegetative soil cover for the area of the groundwater infiltration system;
6. Spot excavation and disposal of soils containing Polychlorinated biphenols (PCBs), lead and antimony, where levels exceed the soil cleanup levels in locations other than the east soils area designated as the disposal area;
7. Excavation of disposal area sludges/fill, which may inhibit in situ treatment; and
8. Establishment of environmental use restrictions on the property.

Post ROD Activities

Soils and Floating Product

Since the issuance of the 1994 ROD, a number of activities have taken place. In 1995, a site-wide delineation of lead impacted soils revealed that lead contamination was more extensive than previously anticipated. Lead was the most widespread contaminant in site soils. In December of 1997, the floating product removal system that was installed in 1982 was replaced with a new system, because removal of floating product occurred at a much slower pace than originally anticipated and had not yet been completed. After several years, the new floating product removal system was still found to be slow and inefficient.

Based on data collected after the ROD, NJDEP, EPA and L.E. Carpenter agreed that modifications to portions of the remedy related to soils and the floating product were warranted.

In April 2004, L.E. Carpenter submitted a work plan to NJDEP and EPA which proposed a more aggressive remedial approach than

anticipated in the ROD. The work plan included, but was not limited to, excavation and off-site disposal of a large on-site area containing floating product smear zone soils (visibly contaminated soils associated with floating product), and a more aggressive approach for excavation of lead contaminated soil to a level of 400 ppm. The aggressive approach to the cleanup resulted in achieving 0.49 ppm of PCBs in the soil, which is the New Jersey Residential Direct Contact Soil Cleanup Criteria. In December 2004, the NJDEP and EPA approved the work plan. The work performed by the PRP under this approved work plan is also known as the source reduction remediation.

Excavation of soil contaminated with lead and process wastes, floating product, and a PCB area began on January 27, 2005 and was completed in June 2005. The approximate amount of material excavated and removed off site for disposal during this phase of the remedial action was 46,521 tons, as follows: lead soils: 9,292 tons; process waste: 450 tons; and floating product smear zone soils (visibly contaminated soils associated with floating product) 34,052 tons; and PCB soils: 2,727 tons.

Description of the Significant Differences and the Basis for those Differences

This ESD addresses changes to the components of the remedy chosen in the 1994 ROD which called for floating product to be removed by an active removal system, the excavation and off-site removal of soils contaminated with lead at levels greater than 600 ppm, and the excavation and off-site removal of soils contaminated with PCB levels greater than 2.0 ppm.

With this document, EPA, after consultation with the NJDEP, modifies the selected remedy for the soils and groundwater as follows (item numbers below correspond to ROD components 1 through 8 listed on page 2):

1. floating product and associated smear zone soils were excavated and disposed of off-site as an alternative to the active removal system selected in the ROD due to the low yield of floating product extraction system previously installed;

3. bis (2-ethlyhexyl) phthalate (DEHP) impacted soils were excavated and disposed of off-site instead of being consolidated into a soil treatment zone;

4. no reinfiltration of treated groundwater will be performed for the purpose of treating soil contamination, as all contaminated site soils were excavated to meet cleanup standards and disposed of off-site;

5. following implementation of the source reduction remediation, all disturbed areas were restored to proposed final grades with a vegetative soil cover. The ROD selected a vegetative cover over the area of groundwater infiltration;

6. excavation and off-site disposal of soils containing PCBs and lead were completed to meet the more stringent New Jersey Residential Direct Contact Soil Cleanup Criteria (RDCSCC) (0.49 ppm and 400 ppm, respectively) instead of the Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (2.0 ppm and 600 ppm, respectively) as required in the ROD;

7. all soils above site-established cleanup levels were excavated and disposed of off-site during the source reduction remediation, instead of the excavation of some soils and on-site treatment through flushing of other soils as selected in the ROD;

8. environmental use restrictions on the property as selected in the ROD are no longer needed since RDCSCC were met for PCBs and lead at the site.

It should be noted that while most of the site soils were excavated to levels below the water table, thereby removing all contaminants, there is a limited area of soils in the southwest corner of the site, called the B-2 area, where soils were excavated to a depth of 2 feet and the excavation was then backfilled with clean fill. Two post-excavation samples collected at the base of this excavation in this area exceeded the NJDEP residential soil cleanup goal for antimony of 14 ppm. The concentrations of antimony collected at the base of the excavation are well below NJDEP's non-residential cleanup goal, and are covered with two feet of clean soil. Based on a review of all post-excavation samples of this limited area, EPA and NJDEP have determined that the concentrations of antimony detected during the post-excavation sampling event do not

warrant environmental use restrictions on the property. A detailed evaluation of this issue is available for review in the site files.

Also, it should be noted that this ESD does not address any changes to component 2 of the ROD which relates to the groundwater portion of the remedy. Therefore, this ESD does not address any changes to the groundwater pump and treat system as required by the ROD. The purpose of the pump and treat system is to address the residual groundwater contamination after the floating product areas have been remediated. The pump and treat component of the remedy is currently being reevaluated. NJDEP's and EPA's review of the groundwater data indicate the potential for Monitored Natural Attentuation (MNA) to be an appropriate groundwater remedy for a portion of the groundwater contamination. In January 2005, L.E. Carpenter began to implement an MNA work plan to collect the required data to determine if MNA will be an effective remedy for this Site. NJDEP and EPA will evaluate the results of this ongoing MNA investigation and will determine, in the future, if MNA is the appropriate remedy for this Site. In addition, further investigations are ongoing to further evaluate an area of benzene, toulene, ethylbenzene and xylene (BTEX) contamination near the Monitoring Well - 19 (MW-19) portion of the site property. This area is not believed to be appropriately addressed by MNA and may need an alternate remedy.

State Comments

NJDEP concurs with EPA's revision to the remedy and decision to issue this ESD.

Affirmation of Statutory Determinations

EPA and NJDEP believe that the modified remedy remains protective of human health and the environment, complies with federal and state requirements that were identified on the ROD and this ESD as applicable or relevant and appropriate to this remedial action, and over the long-term is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

Public Participation Activities

In accordance with the NCP, a formal public comment period is not required when issuing an ESD. However, EPA will announce the availability of the ESD in a local newspaper of general circulation. The ESD has been placed in the site file and the information repository at the NJDEP Offices in Trenton, New Jersey.

George Pavlou, Director
Emergency & Remedial Response Division

Date 9/27/07

June 19, 2008 NJDEP NOD Letter

State of New Jersey

Jon S. Corzine
Governor

Department of Environmental Protection

Lisa P. Jackson
Commissioner

Bureau of Case Management
401 East State Street
P.O. Box 028
Trenton, NJ 08625-0028
Phone #: 609-633-1455
Fax #: 609-633-1439

June 19, 2008

CERTIFIED MAIL/RRR
7005 1160 0004 0964 2605 ✓

CHRISTOPHER ANDERSON, DIRECTOR
LE CARPENTER
33587 WALKER RD
AVON LAKE, OH 44012

NOTICE OF DEFICIENCY

Re: Remedial Action Progress Reports for:
L E Carpenter
170 North Main St
Wharton, Morris County,
SRP PI# 003017
Activity Number Reference: RPC060001

Dear Mr. Anderson:

The New Jersey Department of Environmental Protection (Department) acknowledges receipt the receipt of Remedial Action Progress Reports for 2Q2006, 3Q2006, 4Q2006, 1Q2007, 2Q2007, 3Q2007, 4Q2007, and 1Q2008 submitted pursuant to the Administrative Consent Order (ACO) executed on September 26, 1986 and the Technical Requirements for Site Remediation at N.J.A.C. 7:26E (Tech Rule).

Deficiency

The Department has completed its review of the above mentioned submittals and has identified the following deficiency:

Description of Deficiency: Pursuant to Paragraph 29 of the Administrative Consent Order, failure to conduct additional remediation as directed and to submit subsequent Remedial Investigation Reports and Remedial Action Reports in accordance with N.J.A.C. 7:26E as applicable..

Corrective Action

To correct these deficiencies please take the following actions or make the required submittals within the timeframes indicated:

Submit a Remedial Investigation Workplan within 60 days after receipt of this notice.

Detailed Explanation:

1. **7:26E-4.4(h)3vii: Failure to properly evaluate any surface water body potentially impacted by contaminated ground water.**

   Table 5. Although not stated, LE Carpenter appears to have applied New Jersey Surface Water Quality Criteria for **FW-2** surface water for its assessment of ground water impacts to the Rockaway River. This is incorrect. The correct classification is **FW-2-NT(C1)**. This classification applies to the Rockaway River from the point of discharge of Washington Forge Pond to the Route 46 Bridge. The **C-1** classification prohibits any detectable site related contamination in surface waters above background due to ground water or other discharge. The River sampling results indicate a xylene "J" value of 1.1 ppb at sampling point **SW-R1.** The 3rd Quarter 2006 River sampling results indicated a DEHP "J" value of 2.00 ppb at sampling point **SW-R3.** "J" values have also been reported for site related contaminants at other River sampling points for recent sampling events.

   LE Carpenter must implement measures to prevent discharge of site related contaminants to the Rockaway River above background. For all subsequent sampling rounds, New Jersey Surface Water Quality Criteria classification **C-1** shall apply to the sampling results for the River and ditch discharge to the River sampling points **DRC-2** and **SW-D5**.

2. **7:26E-6.3(a): Failure to contain or stabilize contaminants as a first priority, or to prevent contaminant exposure to receptors and to prevent further movement of contaminants through any pathway.**

   Sampling results for new replacement well MW30s (for MW-2) indicate significantly higher contaminant levels after source removal than before in old well MW-2. This contamination is likely discharging into the ditch, as indicated by the surface water sampling results. As stated on page 4-1, "*These data show that residual groundwater contamination remaining in the source reduction area is migrating into the drainage ditch, which is expected given the direction of groundwater seepage flow shown on Figure 5.*"

The Department requires LE Carpenter to institute measures to prevent further discharge of ground water contamination into the ditch and Rockaway River. In order for LE Carpenter to determine the appropriate remedial measures, it shall submit a remedial investigation workplan that delineates groundwater contamination in the vicinity of MW-30S. In addition, an investigation must be conducted to identify the contaminated source(s) areas that are degrading surface water quality in the ditch and the Rockaway River.

Note that if deficiencies included herein are not addressed to the Department's satisfaction within the specified time period the Department will consider them to be violations and may assess penalties pursuant to N.J.A.C. 7:26C-10, or pursuant to the terms stipulated in the ACO.

If you require copies of Department Guidance Documents or applications, many of these are available on the internet http://www.state.nj.us/dep/srp. If you have any questions regarding this matter contact Glenn Savary Case Manager, at (609) 633-0835, or at Glenn Savary@dep.state.nj.us, prior to the date indicated.

Prepared By:

Glenn Savary, Case Manager
Bureau of Case Management

Reviewed By:

Gwen Zervas, P.E., Section Chief
Bureau of Case Management

cc: Nick Clevett, RMT
Patricia Simmons Pierre, EPA
George Blyskun, BGWPA
John Prendergast, BEERA
Health Officer, Wharton
Clerk, Wharton

Appendix C
Boring Logs & Well Details

Client L.E. Carpenter and Company
Project L.E. Carpenter Remedial Investigation
Location Wharton, New Jersey
Drilling Contractor Moretrench American Corporation
Inspector JGS
Surface Elev. 635.92 (ft. MSL) (at GEI-21)

Boring No. GEI-2 Cluster
Sheet 1 of 2
File No. 38072
Date Started 8/17/89
Date Completed 8/22/89

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			0	SM	Brown, very fine to fine SAND, trace Silt, few cobbles and boulder
			5		Same as above.
			10	SP	Brown gray, medium to coarse SAND, some fine Gravel; occasional boulders.
			15		Gray; medium to coarse(+) SAND, some fine Gravel; occasional cobbles.
			20		Same as above.

Sampler Type: ☒ Cuttings

Boring Method: Air Rotary
10"/8"/6" Air Hammer

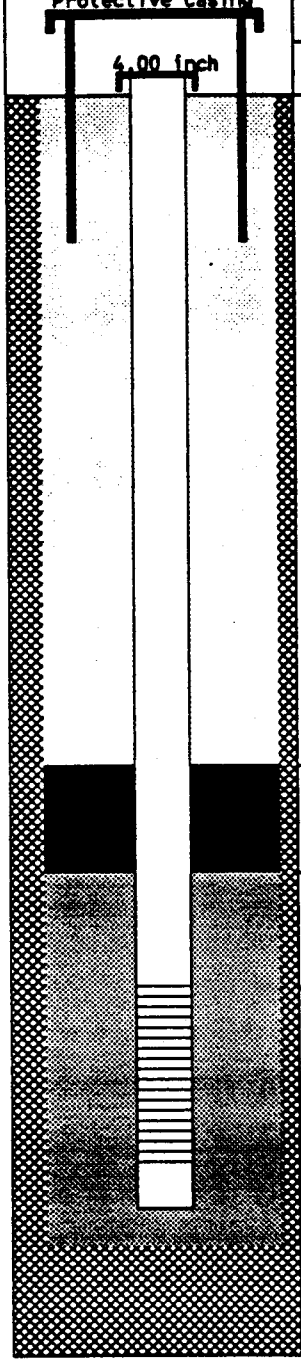
GeoEngineering, Inc.

Well Completion Summary — *Roy F. WESTON, Inc.*

CLIENT	LECARPENTER	DRILLING FIRM	SUMMIT DRILLING INC.
SITE NAME	LE CARPENTER	INSPECTOR	BURNS/HACKETT

WELL ID	MW-12R
START DATE	05/07/96
COMPLETION DATE	05/07/96

WATER LEVELS
7.54 FT (TOC) ON 05/15/96



DEPTH		ELEV.
2.55	TC	2.55
0.00	GS	0.00
0.50	BN	-0.50
1.80	SP	-1.80
2.45	SC	-2.45
14.45	BS	-14.45
14.45	TD	-14.45

DRILLING SUMMARY

Driller	DECORSO/AQUINO
Drilling Fluid	NOT APPLICABLE
Well Type	SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 inch Interval: 0.00 to 2.45 ft.
Type : PVC SCH 40

Stick Up Inner Casing: 2.55 ft. Protective Casing: 0.00 ft.

Casing Grout: CEMT/BENT Interval: 0.00 to 0.50 ft.

Seal Type: BENTONITE Interval: 0.50 to 1.80 ft.

Sand Pack Type: #2 MORIE Interval: 1.80 to 15.00 ft.
Grain Size: Median Diameter:
Screen Diameter: 4.00 Interval: 2.45 to 14.45 ft.
Type : PVC Slots: 0.02 inches

Silt Trap Interval: 0.00 to 0.00 ft.
Backfill Type: Interval: 0.00 to 0.00 ft.

WELL DEVELOPMENT

Date: 05/15/95
Method: Pump & Surge/Overpump
Yield: 5 gpm Purged Volume: 200 gal

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth

= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:
Product noted on discharge water. All development water containerized. A #00 Sand pack installed at 1.8 to 2.5 feet

NOTE: Well Diagram not to Scale

Elevations are feet above mean sea level

06/07/96

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	LECARPENTER	TOTAL DEPTH	:	17.00
SITE NAME	:	LE CARPENTER	LOGGER	:	HACKETT/BURNS
BORING ID	:	MW-12R	DRILLING COMPANY	:	SUMMIT DRILLING, INC.
NORTHING	:	0.0000 estimated	DRILLING RIG	:	GUS PECH AIR RIG
EASTING	:	0.0000 estimated	DATE STARTED	:	05/07/96
ELEVATION	:	0.000 estimated	DATE COMPLETED	:	05/07/96

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			20	SAND, lt SILT, lt GRAVEL	DK BROWN	LSE	MST	5 6 7 9	OVM 0.0	ASH-LIKE MATERIAL PRESENT
-1	1									
-2	2		15	SAND, lt GRAVEL, lt SILT	DARK BROWN	LSE	WET	9 9 10 14	OVM 0.0	ASH-LIKE MATERIAL IS PRESENT.
-3	3									
-4	4		20	SAND, sm SILT, lt GRAVEL, lt CLAY	DK BROWN	LSE	SAT	6 7 8 7	OVM 0.0	Groundwater encountered approximately 4 ft below grade. Pieces of brick are present and wood.
-5	5									
-6	6		55	SAND, lt GRAVEL, lt SILT	DK BROWN	LSE	SAT	12 13 14 16	OVM 0.0	Pieces of wood are present.
				CLAY, sm SILT, lt SAND	DARK GRAY	SFT	MST		OVM 0.0	Pieces of mica present.
-7	7									
-8	8		30	SAND, lt GRAVEL, lt SILT	DARK GREY	LSE	SAT	12 30 50 50	OVM 734.0	Product noted on soil.
-9	9									
-10	10			SAND, lt SILT	GRAY	LSE	WET		OVM 0.0	Air rotary to 11 feet below grade.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	LECARPENTER	TOTAL DEPTH	:	17.00
SITE NAME	:	LE CARPENTER	LOGGER	:	HACKETT/BURNS
BORING ID	:	MW-12R	DRILLING COMPANY	:	SUMMIT DRILLING, INC.
NORTHING	:	0.0000 estimated	DRILLING RIG	:	GUS PECH AIR RIG
EASTING	:	0.0000 estimated	DATE STARTED	:	05/07/96
ELEVATION	:	0.000 estimated	DATE COMPLETED	:	05/07/96

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				SAND, lt SILT	GRAY	LSE	WET		OVM 0.0	Air rotary to 11 feet below grade.
-11	11		40	SAND, sm GRAVEL, lt SILT	Brown	LSE	SAT	13 10 10 7	OVM 319.0	Drager tube analysis for methylene chloride - No detections. Sheen noted.
-12	12									
-13	13		10	GRAVEL	GREY	LSE	DRY	25 27 30 17	OVM 58.0	PIECE OF GRAVEL BLOCKS RECOVERY
-14	14									
-15	15		25	SAND and GRAVEL, tr SILT	DK GREY	LSE	SAT	11 12 15 22	OVM 0.0	
-16	16									
-17	17									
-18	18									
-19	19									
-20	20									

Client L.E. Carpenter and Company
Project L.E. Carpenter Remedial Investigation
Location Wharton, New Jersey
Drilling Contractor Moretrench American Corporation
Inspector JGS
Surface Elev. 634.74 (ft. MSL) (at MW-151)

Boring No. MW-15 Cluster
Sheet 1 of 2
File No. 88072
Date Started 7/17/89
Date Completed 7/26/89

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			0	FILL	Asphalt.
				SW	Dark brown, fine to coarse Sand, some fine Gravel; frequent cobbles and boulders.
			5		
				SW-GP	Brown, fine to coarse SAND, and fine Gravel; occasional cobbles.
			10		Same as above.
			15		Same as above.
			20		

Sampler Type: ☒ Cuttings

Boring Method: Air Rotary
10"/8" Air Hammer

GeoEngineering, Inc.

File No. 88072 Boring No. MW 15 Sheet 2 of 3

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			20		
					Brown, fine to coarse SAND, and fine Gravel; few cobbles.
				SW-GP	
			25		
					Same as above.
			30		
					Same as above.
			35		
				SW-GP	Same as above.
			40		
					Same as above.
					Boring terminated at 42 feet.
			45		

GeoEngineering, Inc.

Client L.E. Carpenter and Company
Project L.E. Carpenter Remedial Investigation
Location Wharton, New Jersey
Drilling Contractor Moretrench American Corporation
Inspector JGS
Surface Elev. 628.21 (ft. MSL) (at MW-18d)

Boring No. MW-18 Cluster
Sheet 1 of 7
File No. 88072
Date Started 5/24/89
Date Completed 6/8/89

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			0	SW-SM	Dark brown, fine to coarse Sand, some Silt; Organics (roots).
					Brown, fine to coarse Sand, some fine gravel; frequent cobbles and boulders.
				SW	
			5		Same as above.
			10		Same as above.
			15	SW	Same as above.
				SW-GP	
			20		

Sampler Type: ☒ Cuttings
Split Spoon - 140 lb. Hammer

Boring Method: Air/Mud Rotary
10" Hammer, 7 7/8" Roller Bit, 4" Flush Joint Casing, NX Core Barrel

GeoEngineering, Inc.

Project U.S. Carpenter Remedial Investigation
File No. 89072
Boring No. MW-18 cluster
Sheet 1 of -

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			20	SW-GP	Brown, fine to coarse SAND, and fine Gravel; frequent small cobbles.
			25		Same as above.
			30		Same as above.
			35	SW-GP	Same as above.
1	18	20		SP-GP	Brown, medium to coarse SAND, and fine Gravel; frequent small cobbles.
			40	Bldr.	Boulder 40 to 42 feet.
				SP-GP	Brown, medium to coarse SAND, and fine Gravel; frequent cobbles.
			45		

GeoEngineering, Inc.

Project [illegible] Boring No. AW-18

File No. 38072 Sheet 3 of [illegible]

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			45		
				SP-GP	Brown, medium to coarse SAND, and fine to medium Gravel, few cobbles.
			50		
					Same as above.
			55		
			60	SP-GP	Brown, medium to coarse SAND, and fine Gravel; few small cobbles.
			65		Same as above.
			70		

GeoEngineering, Inc.

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			70	Bldr.	Boulder 70 to 71 feet.
				SP-GP	Brown, medium to coarse SAND, and fine Gravel; few small cobbles.
			75		Same as above.
			80		Same as above.
			85	SP-GP	Same as above.
			90	Bldr.	Boulder 89 to 90 feet.
				SW-GP	Light brown, fine to coarse(+) SAND, and fine Gravel.
			95	SP-GP	

Project U.S. Carpenter Remedial Investigation
File No. 88072
Boring No. MW-[redacted] Cluster
Sheet 5 of 7

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			95	SP-GP	Light brown, medium to coarse(+) SAND, and fine Gravel.
			100		Same as above.
			105		Same as above.
			110		Same as above.
			115	SP-GP	Same as above.
			120	SW-GP	

GeoEngineering, Inc.

Project [illegible] Remedial Investigation — Boring No. MW-17 Cluster

File No. 38072 — Sheet 6 of 7

SAMPLE NO.	SAMPLE REC.	BLOWS /12"	DEPTH (FT.)	SOIL TYPE	SOIL DESCRIPTION
			120	SW-GP	Light brown, fine to coarse(+) SAND, and fine Gravel.
			125		Same as above.
					Same as above; few cobbles.
			130		Granite; see sheet 7 for core log.
				Gr	
			135		Boring terminated at 136 feet.

GeoEngineering, Inc.

MONITOR WELL INSTALLATION

Client: L. E. CARPENTER Job No: 3600-05-67 Date Drilled: 5/20/91 Well No: MW-19

Site: WHARTON, NJ Interval: 7-17 FT Top of Steel Casing: _____

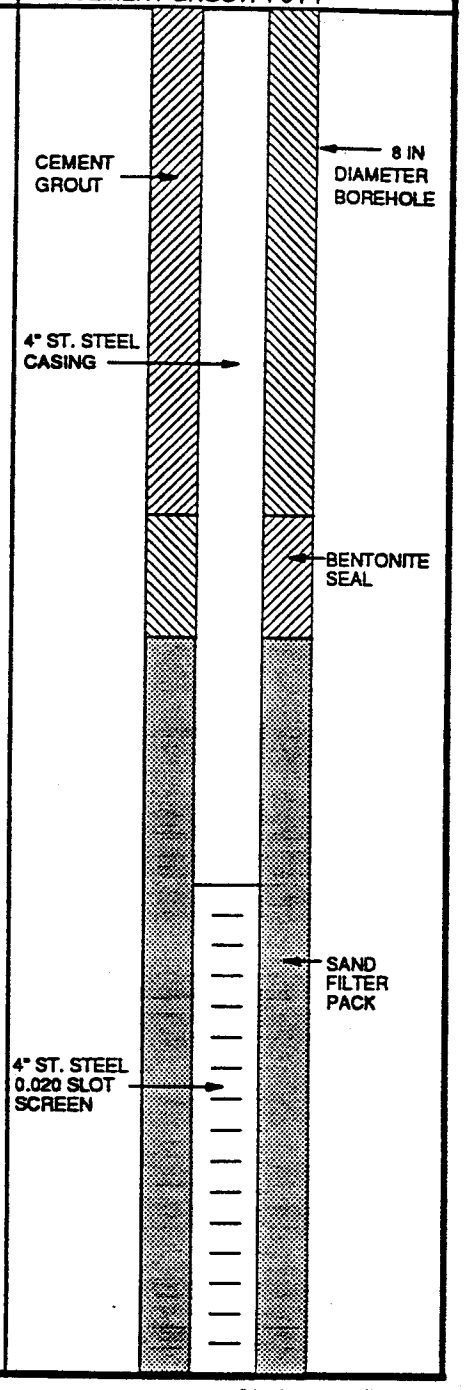
Total Depth: 17.0 FT Casing Size & Type: 4" ST. STEEL Screen Size: 0.020

Comments: _____

Depth	Blow Count	Sample Description
1	2	25% RECOVERY. COARSE SAND FILL. LAST 2" IS BLACK SILTY SAND.
	6	
	10	
2	9	
	13	25% RECOVERY. COARSE SAND FILL OVER SANDY CLAY WITH SMALL PEBBLES
3	14	
	19	
4	27	
	14	25% RECOVERY. YELLOW-BROWN SILTY CLAY.
5	10	
	8	
6	20	COBBLE AND BOULDER ZONE BEGINS
	28	25% RECOVERY. HNU=BG. REDDISH-BROWN CLAY (SAPROLITE) W/ COBBLE FRAGMENTS. SPOON WAS SITTING ON TOP OF COBBLE. REFUSAL ENCOUNTERED.
7	58	
	50/2	
8		
		BOULDERS - DRY HNU=BG NO RECOVERY
9		
10		WATER AT 10 FT

Completion Data

SCREEN: 17-7 FT
SAND FILTER PACK: 17-5 FT
BENTONITE SEAL: 5-4 FT
CEMENT GROUT: 4-0 FT



MONITOR WELL INSTALLATION

Client: L. E. CARPENTER Job No: 3600-05-67 Date Drilled: 5/20/91 Well No: MW-19

Site: WHARTON, NJ Interval: 7-17 FT Top of Steel Casing: _____

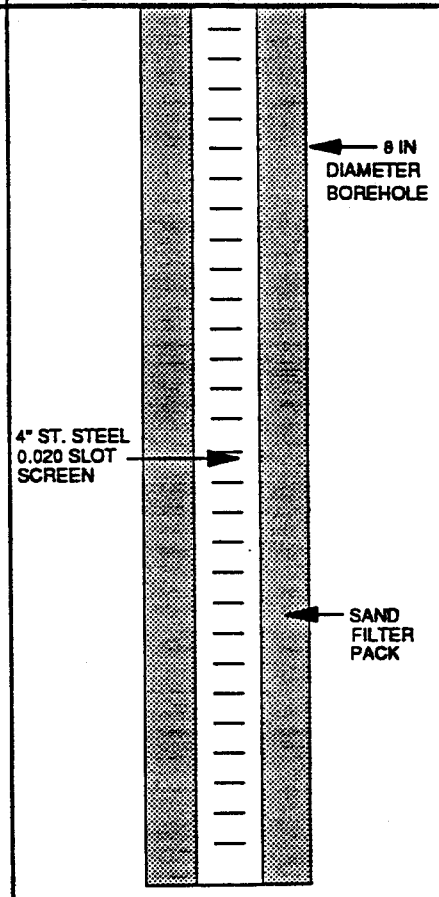
Total Depth: 17.0 FT Casing Size & Type: 4" ST. STEEL Screen Size: 0.020

Comments: _____

Depth	Blow Count	Sample Description
11		HOLE ADVANCED THROUGH COBBLES TO 11 FT
12		75% RECOVERY. BROWN COARSE SAND WITH STRONG ODOR OF MEK. HNU=200 UNITS ON SPOON, 100 UNITS IN BREATHING ZONE. CREW UPGRADED TO LEVEL C.
	23	
	18	
13	52	
	73	100% RECOVERY. LIGHT BROWN SANDY GRAVEL WITH STAINING FROM 14-15 FT. HNU=50 UNITS
14		
15		CUTTINGS - AS ABOVE
16		
17		TD = 17.0 FT
18		MATERIALS: 10 FT 0.020 SLOT ST. STEEL 4" SCREEN 10 FT ST. STEEL 4" CASING 1 BUCKET BENTONITE PELLETS
19		
20		

Completion Data

SCREEN: 17-7 FT
SAND FILTER PACK: 17-5 FT
BENTONITE SEAL: 5-4 FT
CEMENT GROUT: 4-0 FT



MW19 / Hot Spot 1 Area of Concern

Well Completion Summary

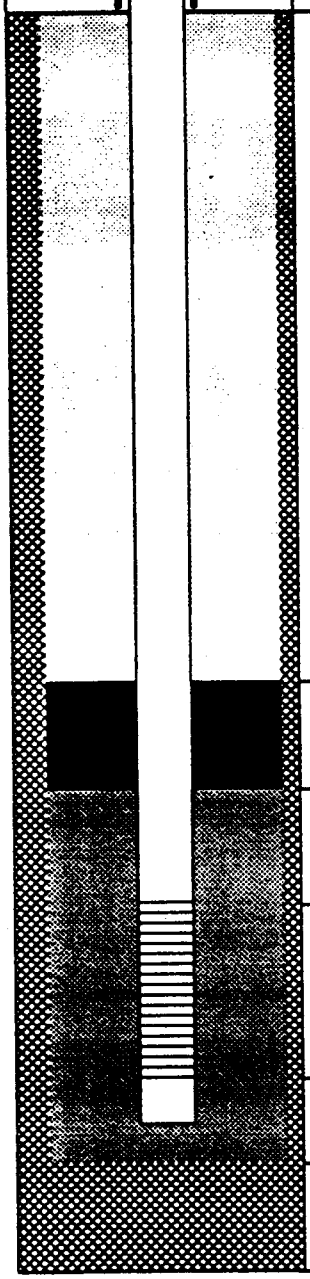
Temp Well points & Boring Logs.

Roy F. WESTON, Inc.

CLIENT	LECARPENTER	DRILLING FIRM	SUMMIT DRILLING, INC.
SITE NAME	MW-19 DELINEATION	INSPECTOR	BURNS/HACKETT

WELL ID	B-1-MW19
START DATE	05/10/96
COMPLETION DATE	05/10/96

WATER LEVELS
9.85 FT (TOC) ON 05/10/96



DEPTH		ELEV.
0.05	TC	0.05
0.00	GS	0.00
0.00	BN	0.00
0.00	SP	0.00
9.83	SC	-9.83
14.83	BS	-14.83
14.83	TD	-14.83

DRILLING SUMMARY

Driller	DECORSO
Drilling Fluid	NOT APPLICABLE
Well Type	SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 2.00 inch Interval: 0.00 to 14.83 ft.
Type : PVC SCH 40

Stick Up Inner Casing: 0.05 ft. Protective Casing: 0.00 ft.

Casing Grout: OTHER Interval: 0.00 to 0.00 ft.

Seal Type: NONE Interval: 0.00 to 0.00 ft.

Sand Pack Type: NONE Interval: 0.00 to 0.00 ft.
Grain Size: Median Diameter:
Screen Diameter: 2.00 Interval: 9.83 to 14.83 ft.
Type : PVC Slots: 0.02 inches

Silt Trap Interval: 0.00 to 0.00 ft.
Backfill Type: NATURAL Interval: 0.00 to 14.83 ft.

WELL DEVELOPMENT

Date: / /
Method:
Yield: Purged Volume:

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth

= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:
Temporary well installed for the collection of groundwater screening samples.

NOTE: Well Diagram not to Scale

Elevations are feet above mean sea level

06/19/96

LOG OF TEST BORING

RMT, INC.

BORING NO. MW19-1
SHEET NO. 1 OF 1

PROJECT NAME L. E. Carpenter
LOCATION Warton, NJ
CONTRACTOR Aquifer Testing & Drilling
DRILLING METHOD Air Rotary Hammer

PROJECT NO. 3868.03
INSTALLATION 2/17/98
SURFACE ELEV. ---
BOREHOLE DIA. 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS	WELL CONSTR
INTERVAL NO.	INTERVAL TYPE	RECOVERY N	RECOVERY IN	PID ppm	DEPTH		
						GRASS/TOPSOIL	
	SS						
A		27-20 12-8	14	1.0		**WELL GRADED SAND WITH SILT AND GRAVEL (SP-SM)**, brown, moist.	
	SS						
B		22-12 12-8	6	1.7	5	**SAME AS ABOVE**	
	SS						
C		14 100/4	4	0.4		**SAME AS ABOVE**, cobble in spoon tip.	
	SS						
D		100/2	3	1.2	▽	**SAME AS ABOVE**, cobble in spoon tip, moist to wet.	
	SS				10		
E		50/0	0	---		**NO RECOVERY**	
	SS						
F		100/1	2	23		**WELL GRADED SAND WITH GRAVEL (SW)**, brown, wet, hydrocarbon odor.	
	SS						
G		11-11 5-3	12	0.2	15	**POORLY GRADED SAND (SP)**, very fine grained, red-brown and black lamina in light brown matrix.	
						END OF BORING AT 16 FEET	

GENERAL NOTES

DATE STARTED 2-17-98
DATE COMPLETED 2-17-98
RIG Reach Drill T650W
CREW CHIEF Jeff Jaworski
LOGGED E.M.V. CHECKED S.C.

WATER LEVEL OBSERVATIONS

WHILE DRILLING ▽ 9.4 feet
AT COMPLETION ▼
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH

N3LBW 38683 4-10-98

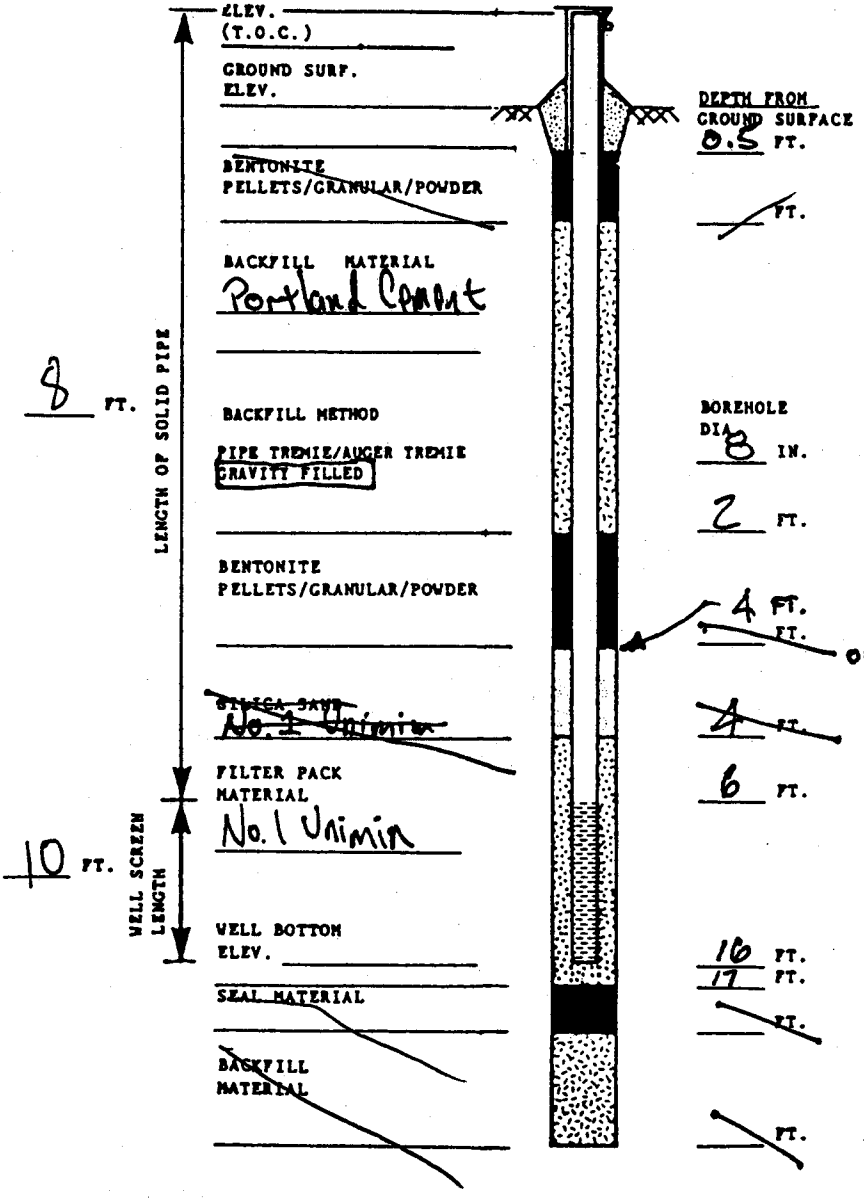
RMT INC

Well Diagram
F-17 (R 11-85)

PROJECT NAME: LE Carpenter NO. _____

WELL NO. MW-19-1

DATE INSTALLED 2/17/98



1) CASING DETAILS

A) TYPE OF PIPE:

PVC, (STAINLESS), TEFLON, OTHER _____

PIPE SCHEDULE _____

B) TYPE OF PIPE JOINTS;

COUPLINGS, (THREADED) (W/TAPE?), OTHER _____

C) WAS SOLVENT USED? YES OR (NO)

D) TYPE OF WELL SCREEN:

PVC, (STAINLESS), TEFLON, OTHER _____

E) WELL SCREEN SLOT SIZE _____

F) PIPE DIA: ID IN. 4 OD IN. _____

G) INSTALLED PROTECTOR PIPE W/LOCK? (YES) OR NO

PROTECTOR PIPE DIA. ___ IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER _____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? _____

C) APPROXIMATE WATER VOLUME: REMOVED _____

ADDED _____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

_____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME _____ FT.

DATE/TIME _____ FT.

DATE/TIME _____ FT.

ADDITIONAL COMMENTS: Six-inch sump in well bottom. Therefore Actual screen @ 6-16.5 ft BGL

LOG OF TEST BORING

RMT, INC.

BORING NO. MW19-2
SHEET NO. 1 OF 1

PROJECT NAME L. E. Carpenter
LOCATION Warton, NJ
CONTRACTOR Aquifer Testing & Drilling
DRILLING METHOD Air Rotary Hammer

PROJECT NO. 3868.03
INSTALLATION 2/17/98
SURFACE ELEV. ---
BOREHOLE DIA. 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS	WELL CONSTR
INTERVAL NO.	INTERVAL TYPE	RECOVERY N	RECOVERY IN	PID ppm	DEPTH		
	SS					GRASS TOP SOIL	
A		9-8 7-8	12	0.0		WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM), red-brown.	
	SS						
B		7-9 13-37	4	0.0		WELL GRADED SAND WITH GRAVEL (SW), light brown, red-brown at about 3.8 ft, moist.	
	SS						
C		3-5 5-4	16	0.0	5	WELL GRADED SAND WITH SILT AND GRAVEL (SW SM), red-brown, moist, with rootlets.	
	SS						
D		6-5 7-9	14	2.6		SAME AS ABOVE	
	SS						
E		7-9 14-16	6	0.0		SAME AS ABOVE, moist to wet, cobble in spoon tip.	
	SS				10		
F		19 50/5	2	0.0		WELL GRADED SAND WITH GRAVEL (SW), red-brown, wet.	
	SS						
G		6-7 8-9	0	---		NO RECOVERY	
	SS						
H		11-12 15-17	6	71	15	SAME AS ABOVE, gray to black.	
						END OF BORING AT 16 FEET	

GENERAL NOTES

DATE STARTED 2-17-98
DATE COMPLETED 2-17-98
RIG Reach Drill T650W
CREW CHIEF Jeff Jaworski
LOGGED E.M.V. CHECKED S.C.

WATER LEVEL OBSERVATIONS

WHILE DRILLING ▽ _____
AT COMPLETION ▼ 9.7 feet
AFTER DRILLING
CAVE-IN: DATE/TIME _____ DEPTH _____
WATER: DATE/TIME _____ DEPTH _____

N3LBW 38683 4-10-98

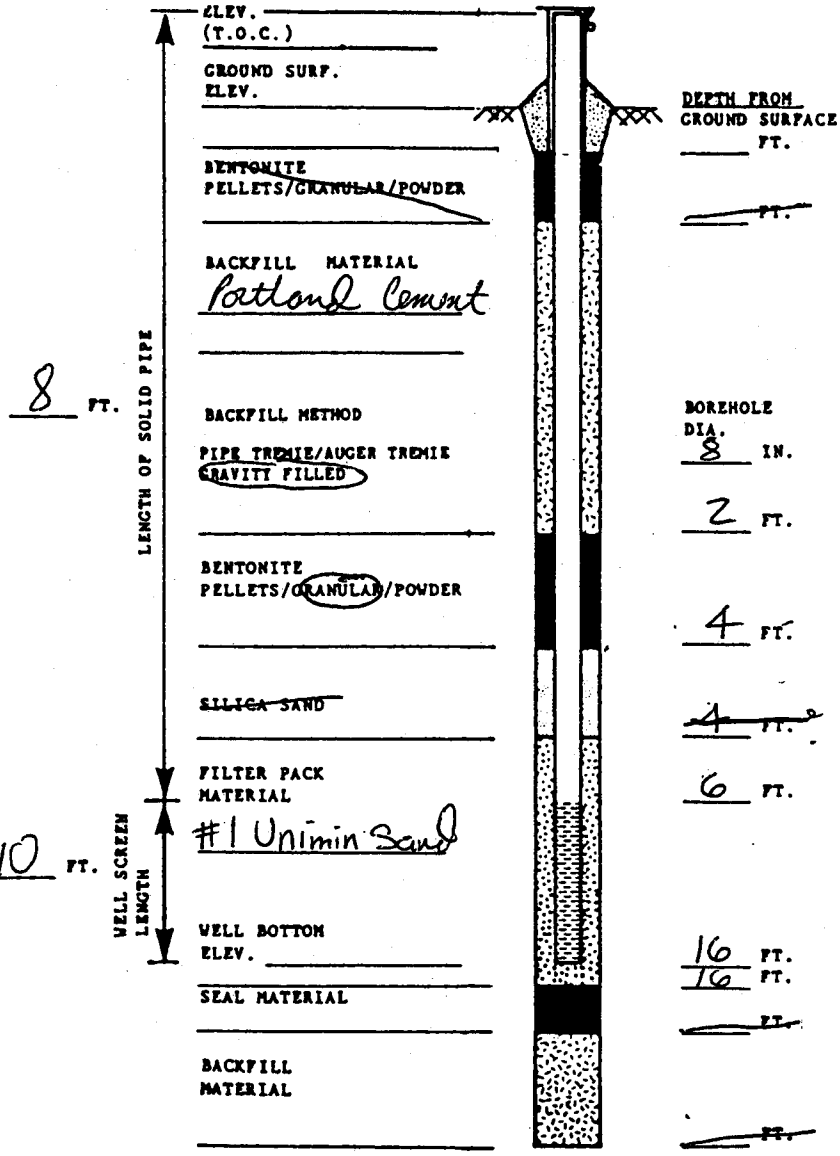
RMT

Well Diagram
F-17 (8 11-85)

PROJECT NAME: LE Carpenter NO. _____

WELL NO. MW-19-2

DATE INSTALLED 2/17/98



1) CASING DETAILS

A) TYPE OF PIPE:

PVC, (STAINLESS) TEFLON, OTHER _____

PIPE SCHEDULE _____

B) TYPE OF PIPE JOINTS;

COUPLINGS, (THREADED) (W/TAPE?), OTHER _____

C) WAS SOLVENT USED? YES OR (NO)

D) TYPE OF WELL SCREEN:

PVC, (STAINLESS) TEFLON, OTHER _____

E) WELL SCREEN SLOT SIZE 0.01

F) PIPE DIA: ID IN. 4 OD IN. _____

G) INSTALLED PROTECTOR PIPE W/LOCK? (YES) OR NO
PROTECTOR PIPE DIA. 6 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER _____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? _____

C) APPROXIMATE WATER VOLUME: REMOVED _____

ADDED _____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

_____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME _____ FT

DATE/TIME _____ FT

DATE/TIME _____ FT

ADDITIONAL COMMENTS: No Sump.

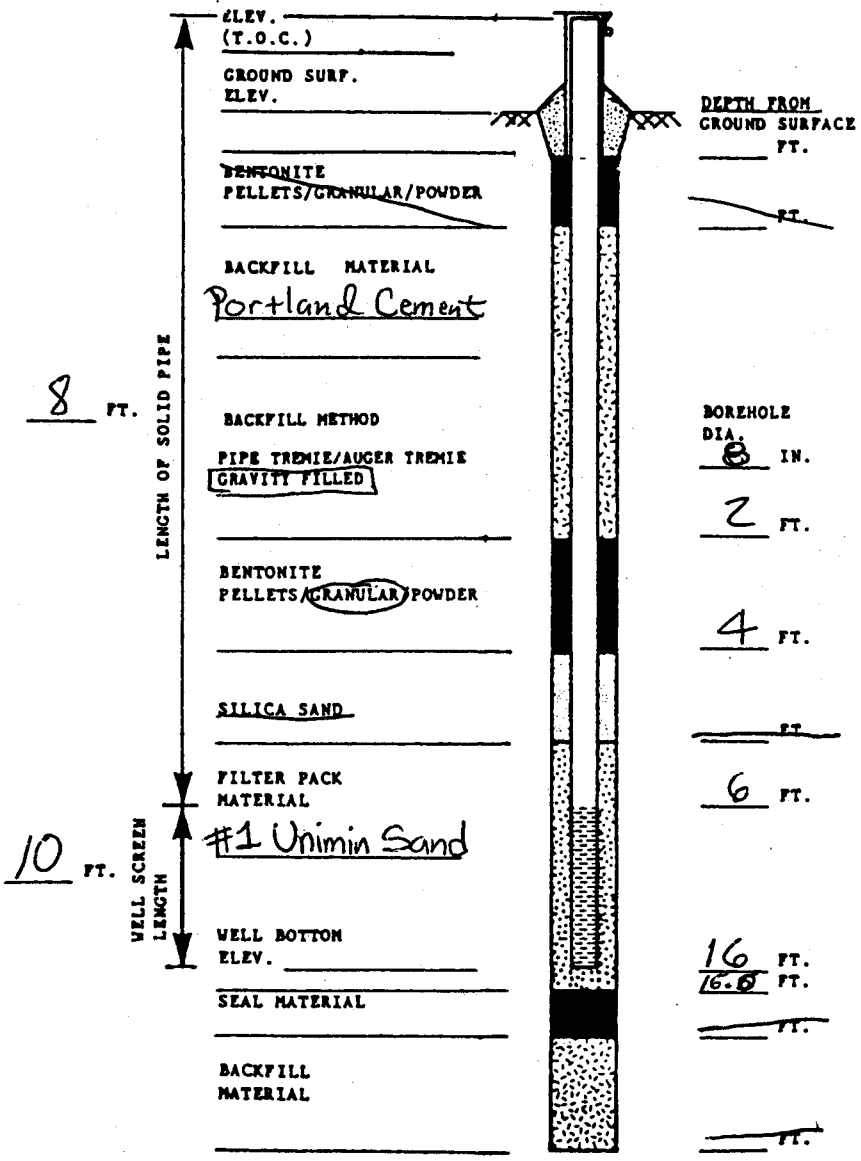
RMT

Well Diagram
F-17 (R 11-85)

PROJECT NAME: LE Carpenter NO. _____

WELL NO. MW-19-3

DATE INSTALLED 2-18-98



1) CASING DETAILS

A) TYPE OF PIPE:

PVC, (STAINLESS), TEFLON, OTHER _____

PIPE SCHEDULE _____

B) TYPE OF PIPE JOINTS;

COUPLINGS, (THREADED) (W/TAPE?), OTHER _____

C) WAS SOLVENT USED? YES OR (NO)

D) TYPE OF WELL SCREEN:

PVC, (STAINLESS), TEFLON, OTHER _____

E) WELL SCREEN SLOT SIZE 0.01

F) PIPE DIA: ID IN. 4 OD IN. _____

G) INSTALLED PROTECTOR PIPE W/LOCK? (YES) OR NO

PROTECTOR PIPE DIA. 6 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER _____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? _____

C) APPROXIMATE WATER VOLUME: REMOVED _____

ADDED _____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

_____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME _____ FT

DATE/TIME _____ FT

DATE/TIME _____ FT

ADDITIONAL COMMENTS: 6" Sump in well bottom. Therefore Actual Screen @ 6-15.5 ft BGL

RMT

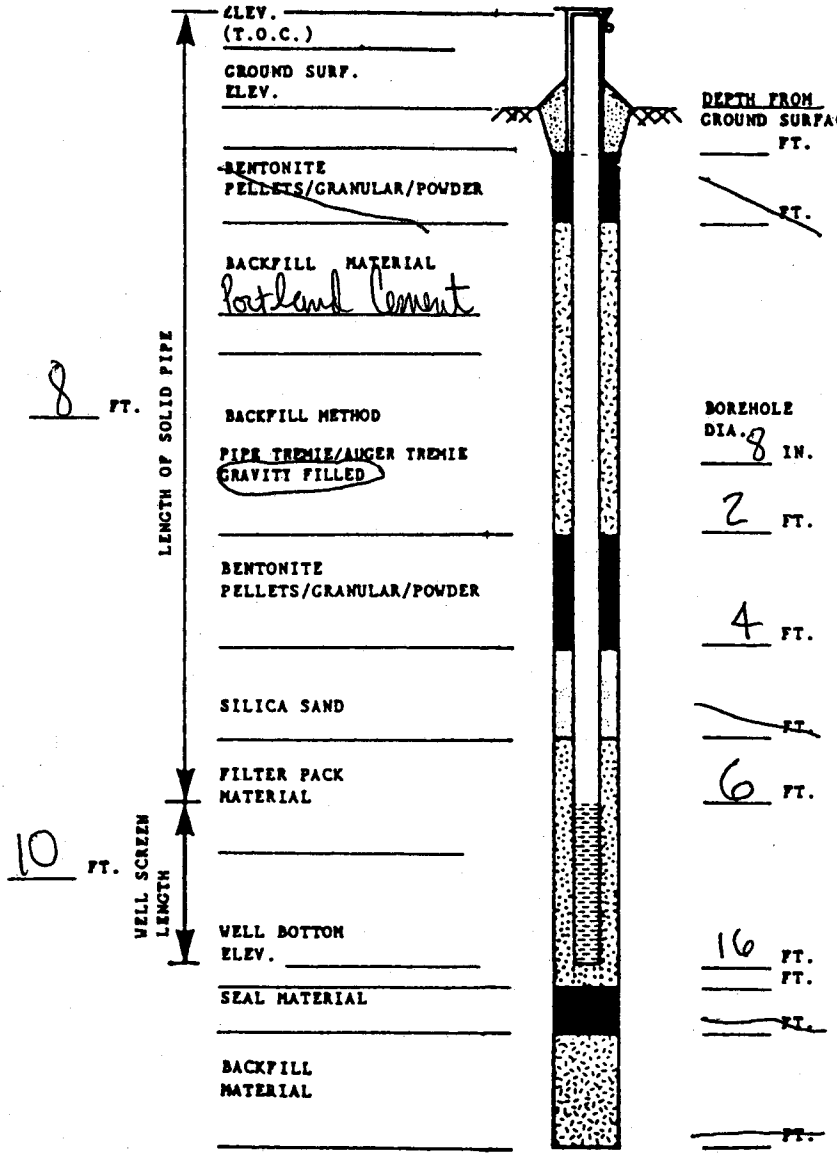
Well Diagram
F-17 (R 11-85)

LE CARVENDER

PROJECT NAME: MW-19-4 NO. _____

WELL NO. _____

DATE INSTALLED 2-18-98



1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER _____

PIPE SCHEDULE _____

B) TYPE OF PIPE JOINTS;

COUPLINGS, THREADED (W/TAPE?), OTHER _____

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER _____

E) WELL SCREEN SLOT SIZE 0.01

F) PIPE DIA: ID IN. 4 OD IN. _____

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

PROTECTOR PIPE DIA. 6 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER _____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? _____

C) APPROXIMATE WATER VOLUME: REMOVED _____

ADDED _____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

_____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME _____ FT

DATE/TIME _____ FT

DATE/TIME _____ FT

ADDITIONAL COMMENTS: 6" Sump @ well bottom. Therefore actual screen is @ 6-15.5 ft bgl.

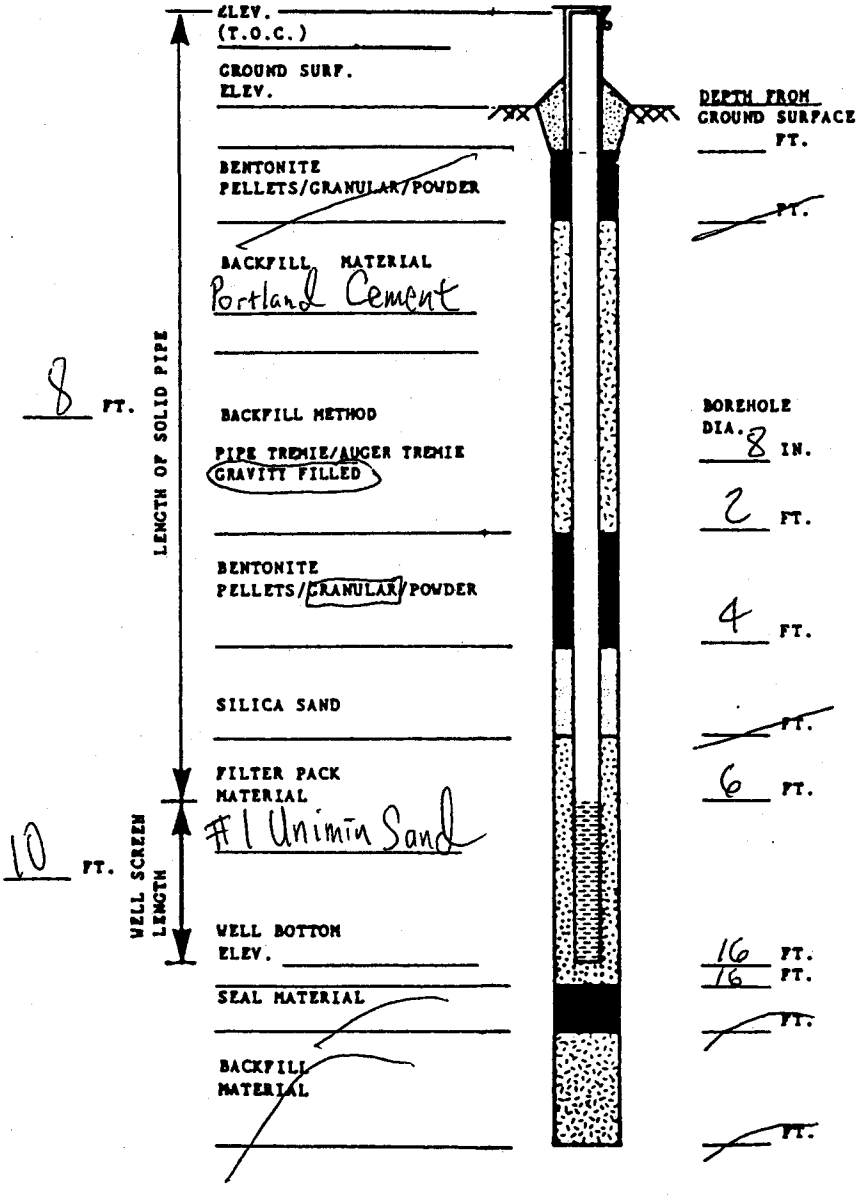
RMT

Well Diagram
F-17 (R 11-85)

PROJECT NAME: LE Carpenter NO. _____

WELL NO. MW-19-5

DATE INSTALLED 2/18/98



1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER _____

PIPE SCHEDULE _____

B) TYPE OF PIPE JOINTS;

COUPLINGS, THREADED (W/TAPE?), OTHER _____

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER _____

E) WELL SCREEN SLOT SIZE 0.01

F) PIPE DIA: ID IN. 2 OD IN. _____

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

PROTECTOR PIPE DIA. 6 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER _____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? _____

C) APPROXIMATE WATER VOLUME: REMOVED _____

ADDED _____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

_____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME _____ FT

DATE/TIME _____ FT

DATE/TIME _____ FT

ADDITIONAL COMMENTS: 6" sump in well bottom, therefore actual screen @ 6-15.5 ft BGL.

MW19/Hot Spot 1
MW19-6, MW19-7 & MW19-8

JC

SUMMIT DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

Chimney Rock Road, Bldg. 9W
Bound Brook, NJ 08805
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (732) 356-1009
http://www.summitdrilling.com
email: info@summitdrilling.com

WELL LOG

WELL: MW19-6 DATE DRILLED: 10/28/1999 COORD #1: 25.02.394 PERMIT #1: 25-55284
COORD #2: PERMIT #2: COUNTY: Morris
SITE: L. E. Carpenter & Co., 170 North Main St., , Wharton, NJ 07885 XSTREET: Ross Street
OWNER: L. E. Carpenter, 170 North Main Street, , Wharton, NJ 07885 USE: Monitoring

INNER CASING:	S. Steel	OUTER CASING:		SCREEN TYPE 1:	S. Steel	DRILLING METHOD:	Air Rotary
DIAMETER:	2"	DIAMETER:		SCREEN TYPE 2:		SAMPLING METHOD:	
LENGTH:	10'	LENGTH:		DIAMETER:	2"	HOLE DIA:	6", 6"
				LENGTH 1:	10"	TOTAL DEPTH:	20'
SET WELL:	20'	GAL PER MIN:	3	LENGTH 2:			
GRAVEL PK SZ:	Morie #2	STAT H2O LVL:	11'	SLOT SIZE:	.020		
DRILLER:	Steve Yotcoski	DEVELOPMENT METHOD:	Pump	CASING SEAL:	Portland		
SURFACE COMPLETION:	M	DEVELOPMENT TIME:	1/2 Hour	OPEN HOLE:			

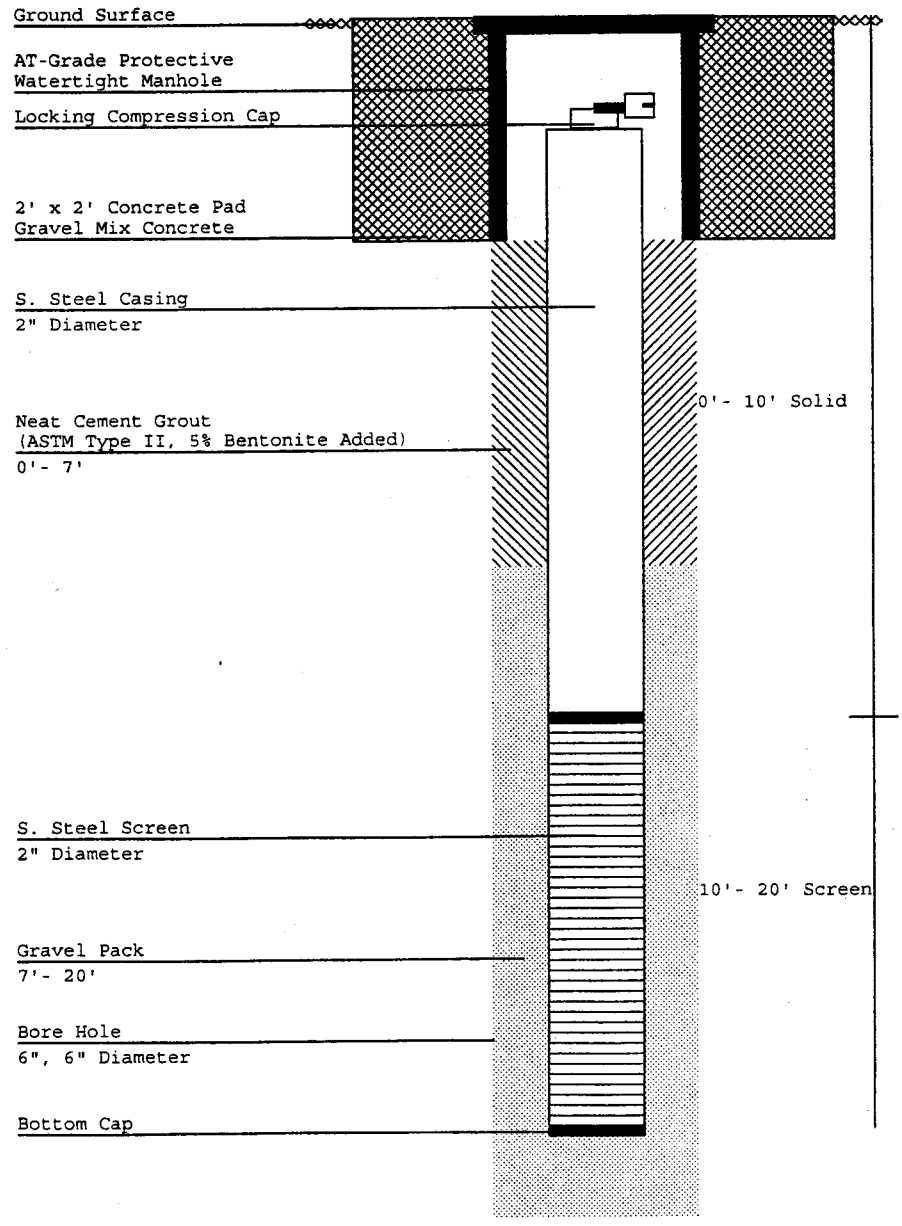
DEPTH BELOW SURFACE FROM - TO

BLOWS PER 6" ON SAMPLER

-

REMARKS / SOILS IDENTIFICATION

0'- 2' Asphalt & stone.
2'- 14' Yellow-brown mdium sand & gravel some cobbles.
14'- 20' Grey m/c sand & gravel some silt trace cobbles.



DWR-138 M
11/98

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 25 - 55284

Atlas Sheet Coordinates 25 . 02 394

OWNER IDENTIFICATION - Owner LE CARPENTER COMPANY
Address 170 N. MAIN ST.
City WHARTON State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW-10 R
County MORRIS Municipality WHARTON BORO Lot No. 2 Block No. 801
Address 170 N. MIAN ST.

DATE WELL STARTED 10/ 28/ 99
DATE WELL COMPLETED 10/ 28/ 99

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well OWNER ~~INVESTIGATION~~ Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Cemco -Customs Environmental Mgmt. Tele.#

WELL CONSTRUCTION

Total depth drilled 20' ft.
Well finished to 20' ft.

Borehole diameter:
Top 6" in.
Bottom 6" in.

Well was finished: ☐ above grade
☑ flush mounted

If finished above grade, casing height (stick above land surface ____ ft.

Was steel protective casing installed?
☐ Yes ☒ No

Static water level after drilling 11' ft.

Water level was measured using Tape

Well was developed for 1/2 Hour hours
at 3 gpm

Method of development Pump

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	0'	10'	2"	S. Steel	sch. 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used)	10'	20'	2"	S Steel	sch. 40 .020
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	7'	20'		Morie #2	
Grout	0'	7'		Neat Cement Bentonite	183 lbs. 10 lbs.

Grouting Method tremie
Drilling Method Air Rotary

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity ____ gpm

Pump type: ____

Drilling Fluid ____ Type of Rig B-80

Health and Safety Plan submitted? ☒ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SUMMIT WELL DRILLING CO INC

Well Driller (Print) Steve Yotcoski

Driller's Signature Steve Yotcoski

Registration No. J1622 Date 11 / 5 / 99

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

See Attached

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

Chimney Rock Road, Bldg. 9W
Bound Brook, NJ 08805
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (732) 356-1009
http://www.summitdrilling.com
email: info@summitdrilling.com

WELL LOG

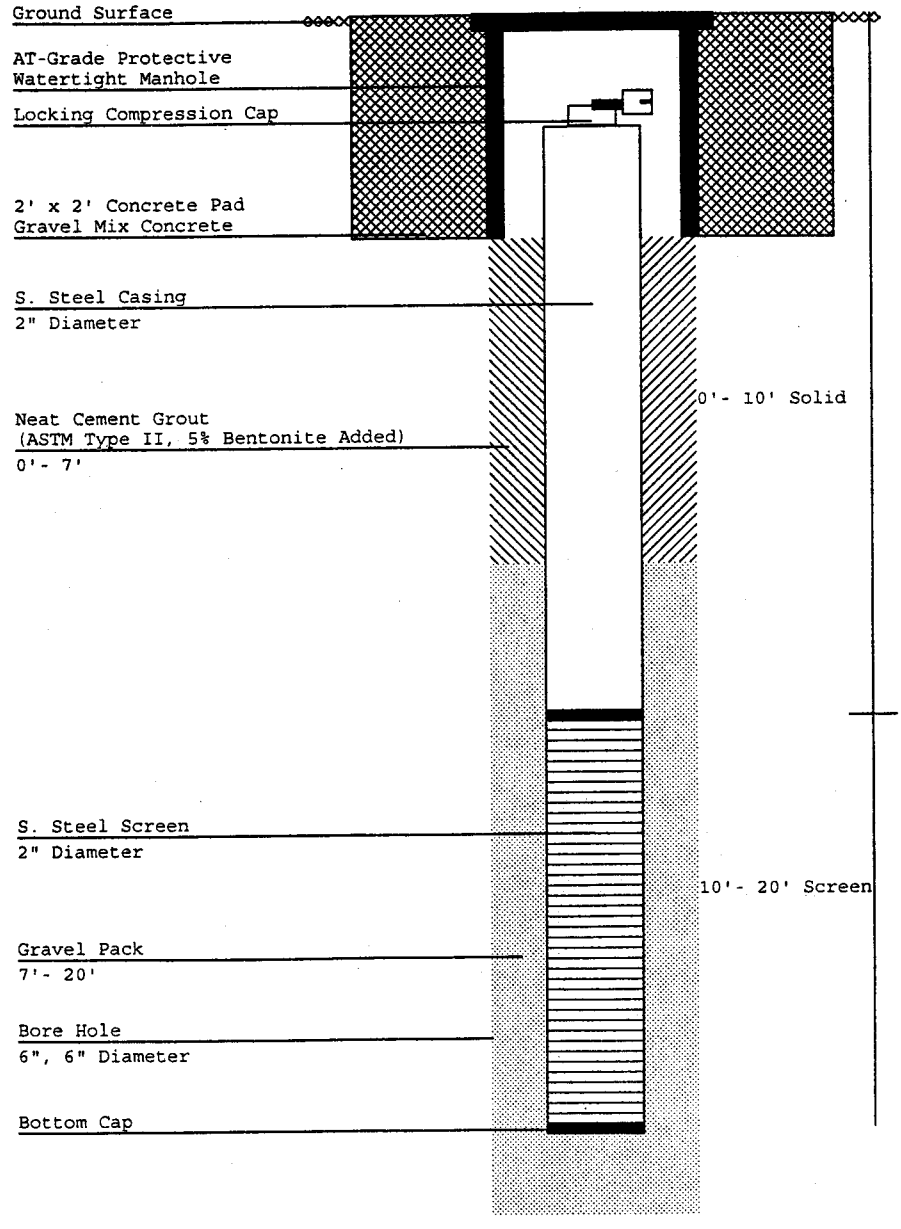
WELL: MW19-7 DATE DRILLED: 10/28/1999 COORD #1: 25.02.394 PERMIT #1: 25-55285
COORD #2: PERMIT #2: COUNTY: Morris
SITE: L. E. Carpenter & Co., 170 North Main St., , Wharton, NJ 07885 XSTREET: Ross Street
OWNER: L. E. Carpenter, 170 North Main Street, , Wharton, NJ 07885 USE: Monitoring

INNER CASING:	S. Steel	OUTER CASING:		SCREEN TYPE 1: S. Steel	DRILLING METHOD: Air Rotary
DIAMETER:	2"	DIAMETER:		SCREEN TYPE 2:	SAMPLING METHOD:
LENGTH:	10'	LENGTH:		DIAMETER: 2"	HOLE DIA: 6", 6"
				LENGTH 1: 10"	TOTAL DEPTH: 20'
SET WELL:	20'	GAL PER MIN: 3		LENGTH 2:	
GRAVEL PK SZ:	Morie #2	STAT H2O LVL: 11'		SLOT SIZE: .020	
DRILLER:	Steve Yotcoski	DEVELOPMENT METHOD: Pump		CASING SEAL: Portland	
SURFACE COMPLETION:	M	DEVELOPMENT TIME: 1/2 Hour		OPEN HOLE:	

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER
-	

REMARKS / SOILS IDENTIFICATION

0'- 2' Asphalt & stone.
2'- 15' Yellow-brown mdium sand & gravel some cobbles.
15'- 20' Grey m/c sand & gravel some silt trace cobbles.



DWR-138 M
11/98

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 25 - 55285

Atlas Sheet Coordinates 25 .02 394

OWNER IDENTIFICATION - Owner LE CARPENTER COMPANY
Address 170 N. MAIN ST.
City WHARTON State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~MW19-7~~ 2
County MORRIS Municipality WHARTON BORO Lot No. Block No. 801
Address 170 N. MIAN ST.

DATE WELL STARTED ~~10/28/99~~
DATE WELL COMPLETED ~~10/28/99~~

TYPE OF WELL (as per Well Permit Categories) ~~OWNER~~ MONITORING ~~INVESTIGATION~~
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Cemco -Customs Enviromental Mgmt. Telep#

WELL CONSTRUCTION

Total depth drilled 20' ft.
Well finished to 20' ft.

Borehole diameter:
Top 6" in.
Bottom 6" in.

Well was finished: ☐ above grade
☑ flush mounted

If finished above grade, casing height (stick above land surface ____ ft.

Was steel protective casing installed?
☐ Yes ☒ No

Static water level after drilling 11' ft.

Water level was measured using Tape

Well was developed for 1/2 Hour hours at 3 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	0'	10'	2"	S. Steel	Sch. 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used)	10'	20'	2"	S. Steel	Sch. 40 .020
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	7'	20'		Morie #2	
Grout	0'	7'		Neat Cement Bentonite	188 lbs. 10 lbs.

Grouting Method tremie
Drilling Method Air Rotary

Method of development Pumo

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity ____ gpm

Pump type: ____

Drilling Fluid ____ Type of Rig B-80

Health and Safety Plan submitted? ☒ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SUNMIT WELL DRILLING CO INC

Well Driller (Print) Steve Yotcoski

Driller's Signature Steve Yotcoski

Registration No. J1622 Date 11 / 8 / 99

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

See Attached

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Summit DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

Chimney Rock Road, Bldg. 9W
Bound Brook, NJ 08805
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (732) 356-1009
http://www.summitdrilling.com
email: info@summitdrilling.com

WELL LOG

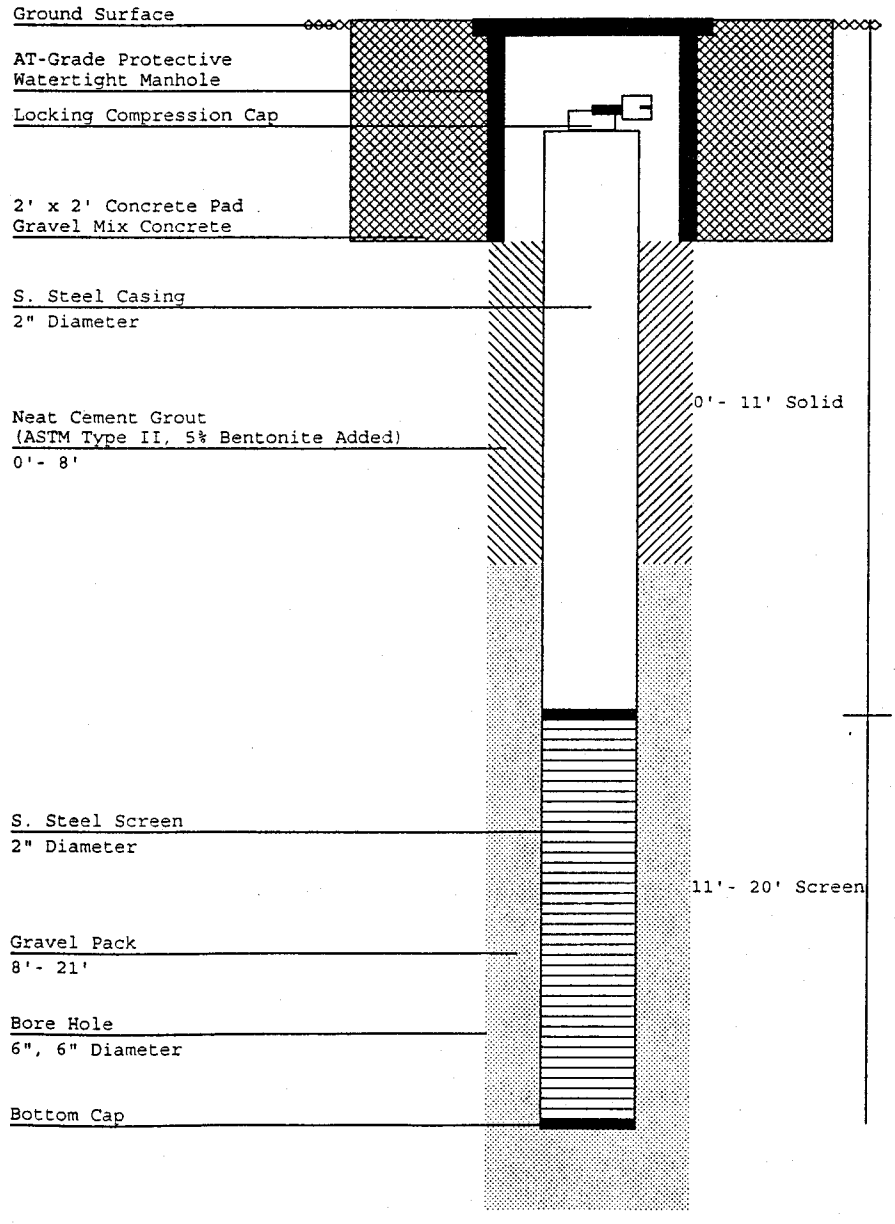
WELL: MW19-8 DATE DRILLED: 10/29/1999 COORD #1: 25.02.394 PERMIT #1: 25-55286
COORD #2: PERMIT #2: COUNTY: Morris
SITE: L. E. Carpenter & Co., 170 North Main St., , Wharton, NJ 07885 XSTREET: Ross Street
OWNER: L. E. Carpenter, 170 North Main Street, , Wharton, NJ 07885 USE: Monitoring

INNER CASING: S. Steel	OUTER CASING:	SCREEN TYPE 1: S. Steel		DRILLING METHOD: Air Rotary
DIAMETER: 2"	DIAMETER:	SCREEN TYPE 2:		SAMPLING METHOD:
LENGTH: 11'	LENGTH:	DIAMETER: 2"		HOLE DIA: 6", 6"
		LENGTH 1: 9'		TOTAL DEPTH: 21'
SET WELL: 21'	GAL PER MIN: 3	LENGTH 2:		
GRAVEL PK SZ: Morie #2	STAT H2O LVL: 11'	SLOT SIZE: .020		
DRILLER: Carmine DeCorso	DEVELOPMENT METHOD: Pump	CASING SEAL: Portland		
SURFACE COMPLETION: M	DEVELOPMENT TIME: 1/2 Hour	OPEN HOLE:		

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER
-	

REMARKS / SOILS IDENTIFICATION

0'- 2' Asphalt & stone.
2'- 21' Glacial till.



DWR-138 M
11/98

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 25 - 55286

Atlas Sheet Coordinates 25 02 394

OWNER IDENTIFICATION - Owner LE CARPENTER COMPANY
Address 170 N. MAIN ST.
City WHARTON State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW19-B
County MORRIS Municipality WHARTON BORO Lot No. 2 Block No. 801
Address 170 N. MIAN ST.

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well OWNER INVESTIGATION Case I.D.#

DATE WELL STARTED 10/29/99
DATE WELL COMPLETED 10/29/99

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Cemco -Customs Enviromental Mgmt Co. Tele.#

WELL CONSTRUCTION

Total depth drilled 21' ft.
Well finished to 21' ft.

Borehole diameter:
Top 6" in.
Bottom 6" in.

Well was finished: ☐ above grade
☒ flush mounted

If finished above grade, casing height (stick up) above land surface ____ ft.

steel protective casing installed?
☐ Yes ☒ No

Static water level after drilling 11' ft.

Water level was measured using Tape

Well was developed for 1/2 Hour hours at 3 gpm

Method of development Pump

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity ____ gpm

Pump type: ____

Drilling Fluid ____ Type of Rig B-60

Health and Safety Plan submitted? ☒ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	0'	11'	2"	S. Steel	sch. 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used)	11'	20'	2"	S Steel	.020 sch. 40
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	8'	21'		Morie #2	
Grout	0'	8'		Neat Cement Bentonite	188 lbs. 10 lbs.

Grouting Method tremie
Drilling Method Air Rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

See Attached

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SUMMIT WELL DRILLING CO INC

Well Driller (Print) Carmine DeCorso

Driller's Signature Carmine DeCorso

Registration No. J1210 Date 11/6/99

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

SERIAL # 010815

DWR-133M (10/96)

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

2555284
2555285
2555286

Mail to
NJDEP
Bureau Water Allocation
[redacted]26
Trenton, NJ 08625-0426

RECEIVED
NOV 18 1999

MONITORING WELL PERMIT 39

Permit No

VALID ONLY AFTER APPROVAL BY THE D.E.P.

COORD #: 25 . 02.394

Owner LE CARPENTER COMPANY
Address 170 N. MAIN STREET
WHARTON NJ 07885

Name of Facility
Address SAME

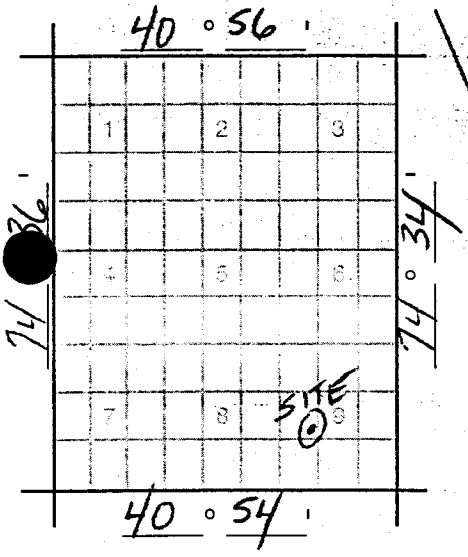
Driller Summit Drilling Co., Inc.
Address Central Jersey Industrial Park
Chimney Rock Road, Building 9W
Bound Brook, NJ 08805

Diameter of Well(s) 2 Inches	Proposed Depth of Well(s) 20 Feet
# of Wells Applied for (max. 10) 3	Will pumping equipment be installed? YES ☐ NO ☒
Type of Well (see reverse) MONITORING	If Yes, give pump capacity cumulative GPM

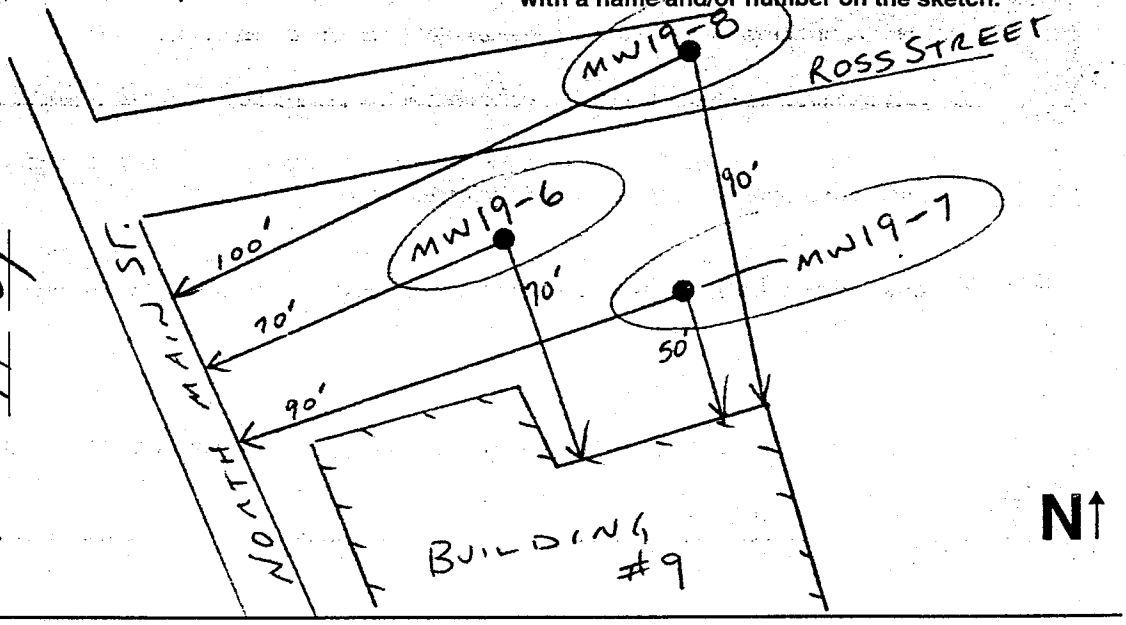
LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
2	801	WHARTON	MORRIS

State Atlas Map No. 25



Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☒ Other (explain) OWNER INVESTIGATION

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
OCT 18 1999
BUREAU OF WATER ALLOCATION

FOR D.E.P. USE

- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☒ For monitoring purposes only
- ☐
- ☒ The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 10-13-99 CEMCO
Signature of Driller John Vost
Registration No. J1544
Signature ☒ Owner FOR Jeff Lux (MS)

COPIES: Water Allocation — White; Health Dept. — Yellow; Owner — Blue; Driller — White

LOG OF TEST BORING

RMT INC.

BORING NO. MW19-9D
SHEET NO. 1 OF 1

PROJECT NAME LEC
LOCATION MW-19-9D, LEC
CONTRACTOR Summit Drilling Company
DRILLING METHOD Air rotary

PROJECT NO. 3868.25
INSTALLATION 7/10/01
SURFACE ELEV.
BOREHOLE DIA. 6 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL NO.	INTERVAL TYPE	RECOVERY PID (ppm)		MOISTURE	DEPTH	
						BLACKTOP & GRAVEL.
1	SS	26/14/11/10	12	NR		**SAND (SP)**, medium grained, few coarse sand, cobbles, medium brown.
2	SS	12/22/10/9	6	NR	5	
3	SS	10/7/11/12	1	NR		
4	SS	2/10/11/16	4	NR		**SAND AND GRAVEL (SP-GP)**, medium sand and gravel, medium brown.
5	SS	10/9/9/18	0	NR	▽ 10	**SAND AND GRAVEL (SP-GP)**, as above, wet.
					15	**GRAVEL (GP)**, with silt, sand and cobbles,
					20	**SAND AND GRAVEL (SP-GP)**. yellowish brown, running.
					25	
					30	
					35	End of boring at 35 feet below ground surface.

GENERAL NOTES

DATE STARTED 7-10-01
DATE COMPLETED 7-10-01
RIG
CREW CHIEF Rich
LOGGED JPM CHECKED

WATER LEVEL OBSERVATIONS

WHILE DRILLING ▽ 10.0
AT COMPLETION ▼
AFTER DRILLING
CAVE-IN: DATE/TIME NA DEPTH NA
WATER: DATE/TIME 7/10/01 DEPTH NA

N3LBN-NO WELL 3868-25.GPJ 10-9-01

SUMMIT DRILLING CO., INC.
ENVIRONMENTAL SPECIALISTS

Chimney Rock Road, Bldg. 9W
Bound Brook, NJ 08805
Telephone: (908) 722-4266
Toll Free: (800) 242-6648
FAX: (732) 356-1009
http://www.summitdrilling.com
email: info@summitdrilling.com

WELL LOG

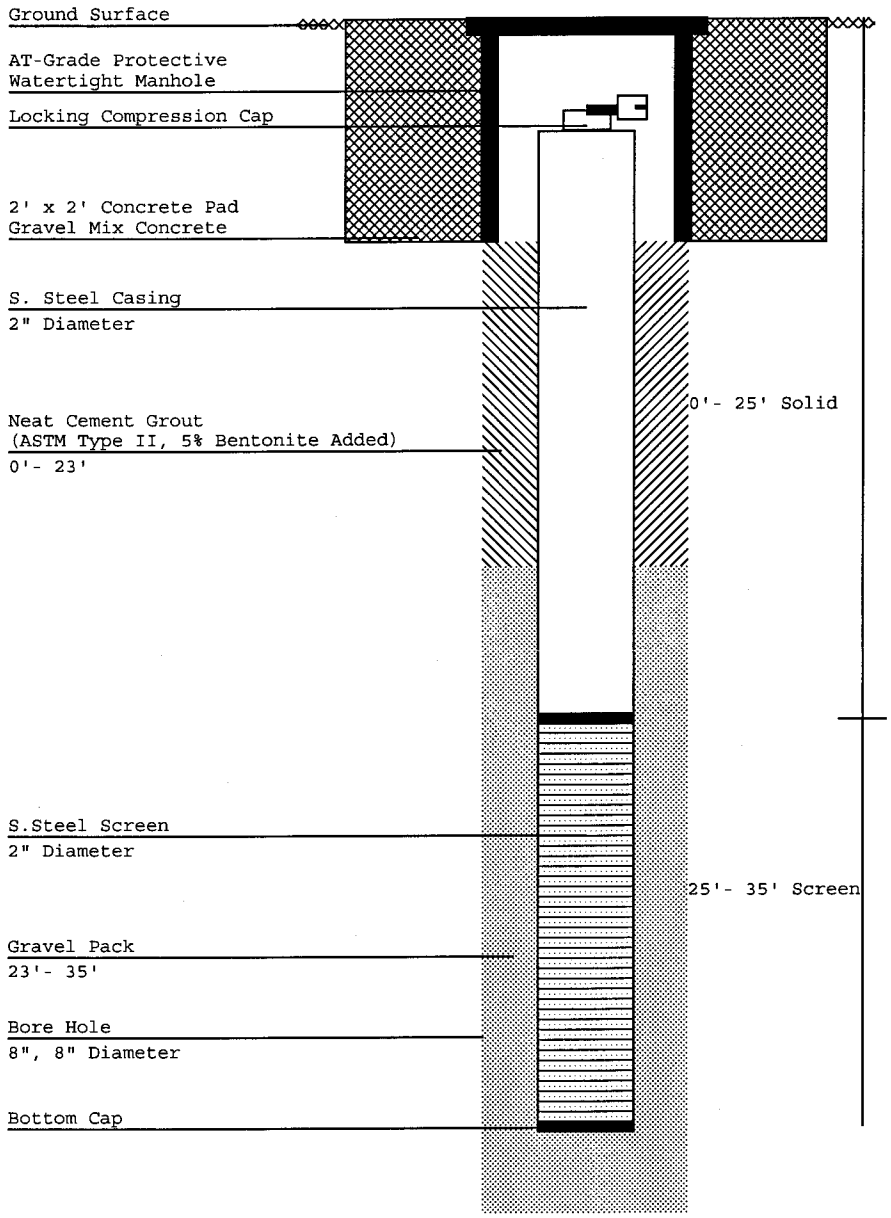
WELL: MW19-9D DATE DRILLED: 07/10/2001 COORD #1: 25.02.397 PERMIT #1: 25-58293
COORD #2: PERMIT #2: COUNTY: Morris
SITE: L. E. Carpenter & Co., 107 North Main St., , Wharton, NJ 07885 XSTREET: Ross Street
OWNER: L. E. Carpenter, 107 North Main Street, , Wharton, NJ 07885 USE: Monitor

INNER CASING:	S. Steel	OUTER CASING:	SCREEN TYPE 1:	S.Steel	DRILLING METHOD: Auger
DIAMETER:	2"	DIAMETER:	SCREEN TYPE 2:		SAMPLING METHOD:
LENGTH:	25'	LENGTH:	DIAMETER:	2"	HOLE DIA: 8", 8"
			LENGTH 1:	10'	TOTAL DEPTH: 35'
SET WELL:	35'	GAL PER MIN: 1/2	LENGTH 2:		
GRAVEL PK SZ:	Morie #2	STAT H2O LVL: 10'	SLOT SIZE:	.020	
DRILLER:	Jeff Segreaves	DEVELOPMENT METHOD: pump	CASING SEAL:	Portland	
SURFACE COMPLETION: M		DEVELOPMENT TIME: 1/2	OPEN HOLE:		

DEPTH BELOW SURFACE FROM - TO	BLOWS PER 6" ON SAMPLER
0' - 2'	client
2' - 4'	client
4' - 6'	client
6' - 8'	client
8' - 10'	client

REMARKS / SOILS IDENTIFICATION

1" Asphalt.
35' Brown m/f sand boulders cobbles gravel.



DWR-133M
2/00

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

2558293
2558294
2558295

MONITORING WELL PERMIT

7/9

Mail To:
NJDEP
BUREAU OF WATER ALLOCATION
PO BOX 426
TRENTON, NJ 08625-0426

VALID ONLY AFTER APPROVAL BY THE D.E.P.

Permit No. _____

COORD #: 25.02.397

Owner LE CARPENTER + CO.

Address 107 N. MAIN STREET
WHARTON NJ 07885

Driller Summit Drilling Co., Inc.

Address Central Jersey Industrial Park
Chimney Rock Road, Building 9W
Bound Brook, NJ 08805

Name of Facility _____

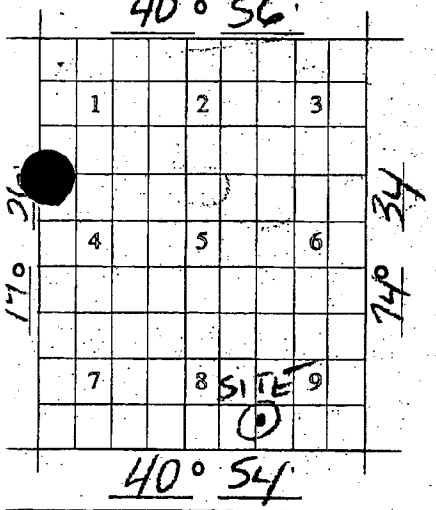
Address SAME

Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	35 Feet
# of Wells Applied for (max. 10)	3	Will pumping equipment be utilized?	YES ☐ NO ☒
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	— cumulative GPM

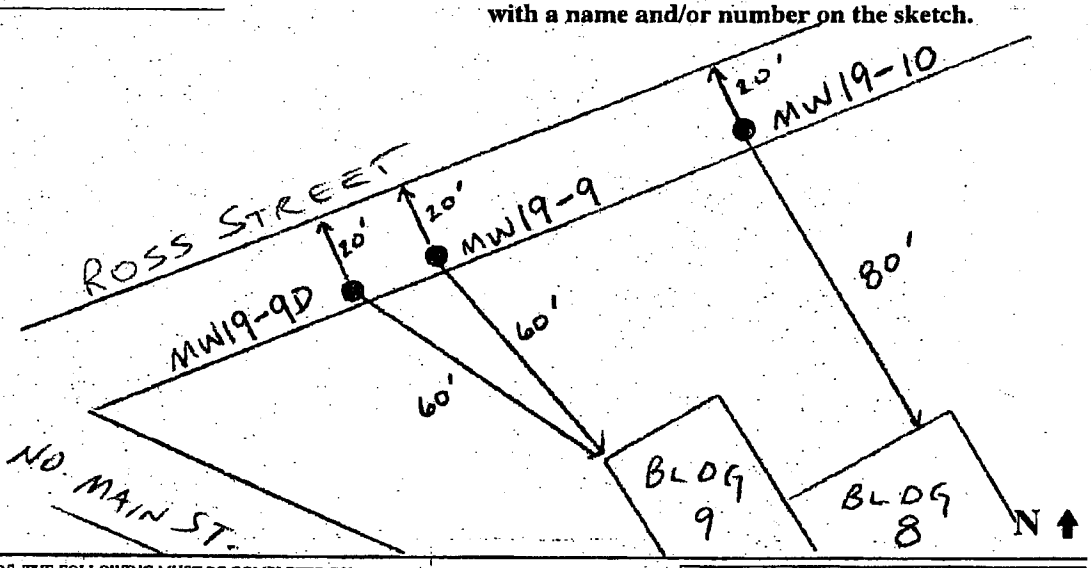
LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
2	801	WHARTON	MORRIS

State Atlas Map No. 25



Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☒ Other (explain) SUPERFUND SITE

CASE I.D. Number _____

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
JUN 4 2001
BUREAU OF WATER ALLOCAT

FOR D.E.P. U
- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☒ For monitoring purposes only
- ☒ The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS PERTAINING TO THIS PERMIT.
In compliance with N.J.S.A.58:4A-14, application is made for a permit to drill a well as described above.

Date 5-31-01 Signature of Driller John Vost Registration No. J1544

RMT Signature of Property Owner FOR John Mulalich (MS)

COPIES: Water Allocation - White Health Dept. - Yellow Owner - Blue Driller - White

DWR-138
8/00

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 25 - 58293

Atlas Sheet Coordinates 25 : 02 : 397

OWNER IDENTIFICATION - Owner LE CARPENTER & CO.
Address 107 N. MAIN ST.
City WHARTON State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. MW19-9D
County MORRIS Municipality WHARTON BORO Lot No. 2 Block No. 801
Address 107 N. MAIN STREET

DATE WELL STARTED 7/10/01
DATE WELL COMPLETED 7/10/01

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) RMT, Inc. Tele. #

WELL CONSTRUCTION

Total depth drilled 35' ft.
Well finished to 35' ft.

Borehole diameter:
Top 8" in.
Bottom 8" in.

Well was finished: ☐ above grade
☒ flush mounted

If finished above grade, casing height (stick up) above land surface ____ ft.

Was steel protective casing installed?
☐ Yes ☒ No

Static water level after drilling 10' ft.

Water level was measured using Tape

Well was developed for 1/2 hours
at 1/2 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	0'	25'	2"	S. Steel	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used)	25'	35'	2"	S. Steel	.020 sch 40
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	23'	35'		Morie #2	
Grout	0'	23'		Neat Cement Bentonite	376 lbs. 20 lbs.

Grouting Method tremie
Drilling Method Auger

Method of development pump

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity ____ gpm

Pump type:

Drilling Fluid Type of Rig B-5

Health and Safety Plan submitted? ☒ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SUMMIT WELL DRILLING CO INC

Well Driller (Print) Jeff Segreaves

Driller's Signature Jeff Segreave

Registration No. J16991 Date 8/1/01

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

See Attached

AS-BUILT WELL LOCATION (NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: _____ EASTING: _____

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

MONITORING WELL CERTIFICATION FORM B LOCATION CERTIFICATION

Name of Owner: L.E. Carpenter & Company
Name of Facility: L.E. Carpenter & Company
Location: 170 North Main Street, Wharton, NJ 07885
Case Number(s): SRP# 002168748 (UST #, ISRA #, Incident #, or ***EPA #***)

LAND SURVEYOR'S CERTIFICATION
Well Permit Number:
(This number must be permanently affixed to - the well casing.) _2_ _5_ - _5_ _8_ _2_ _9_ _3_ - ___

Owners Well Number (As shown on application or plans): MW-19-9D

Geographic Coordinates NAD 83 (to nearest 1/10 of second):

Longitude: West: 74°34'42.412" Latitude: North 40°54'17.938"

New Jersey State Plane Coordinates NAD 83 to nearest 10 feet:

North 754590 East 470442

Elevation of Top of Inner Casing (cap off) at reference mark (nearest 0.01') : 636.70'

Source of elevation datum (benchmark, number/description and elevation/datum. If an on-site datum is used, identify, here, assumed datum of 100', and give approximated actual elevation.)

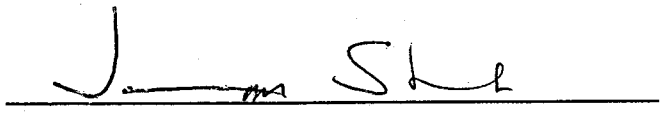
Bench Mark NGS U 18 (681.78 NAVD 88) (682.52 NGVD 29)

Significant observations and notes All elevations are on NGVD 29 to comform to the existing wells

AUTHENTICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of these individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false inaccurate, and complete information and I am committing a crime in the fourth degree if I make a false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

SEAL



PROFESSIONAL LAND SURVEYOR' SIGNATURE

8/31/01
DATE

James M. Stewart Lic # GS26108
PROFESSIONAL LAND SURVEYOR'S NAME AND LICENSE NUMBER

9622 Evans Street, Philadelphia, PA 19115 215 969 1577
PROFESSIONAL LAND SURVEYOR'S ADDRESS AND PHONE NUMBER

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-19-12

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/7/06	6/7/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	17.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 6/8/06 00:00 ▼ Depth (ft bgs) 7.25

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	Asphalt					
1 CS	39			**Sand**- mostly fine sand, some medium sand, little coarse sand, and gravel, loose, moist, no odor, very dark gray brown (10YR3/2).	SW			0	
			5						
2 CS	65			**Sand**- mostly medium sand, some fine and coarse sand, little gravel, loose, moist grading to wet, no odor, dark yellow brown (10YR4/4). ▼	SW			0	
			10						
3 CS	95							0	
				Sand- mostly medium sand, some fine sand, little coarse sand, trace gravel and cobble, loose, wet, no odor, deark gray (10YR4/1).					
4	29		15		SW			0	
				End of Boring 17.0'.					
			20						
			25						

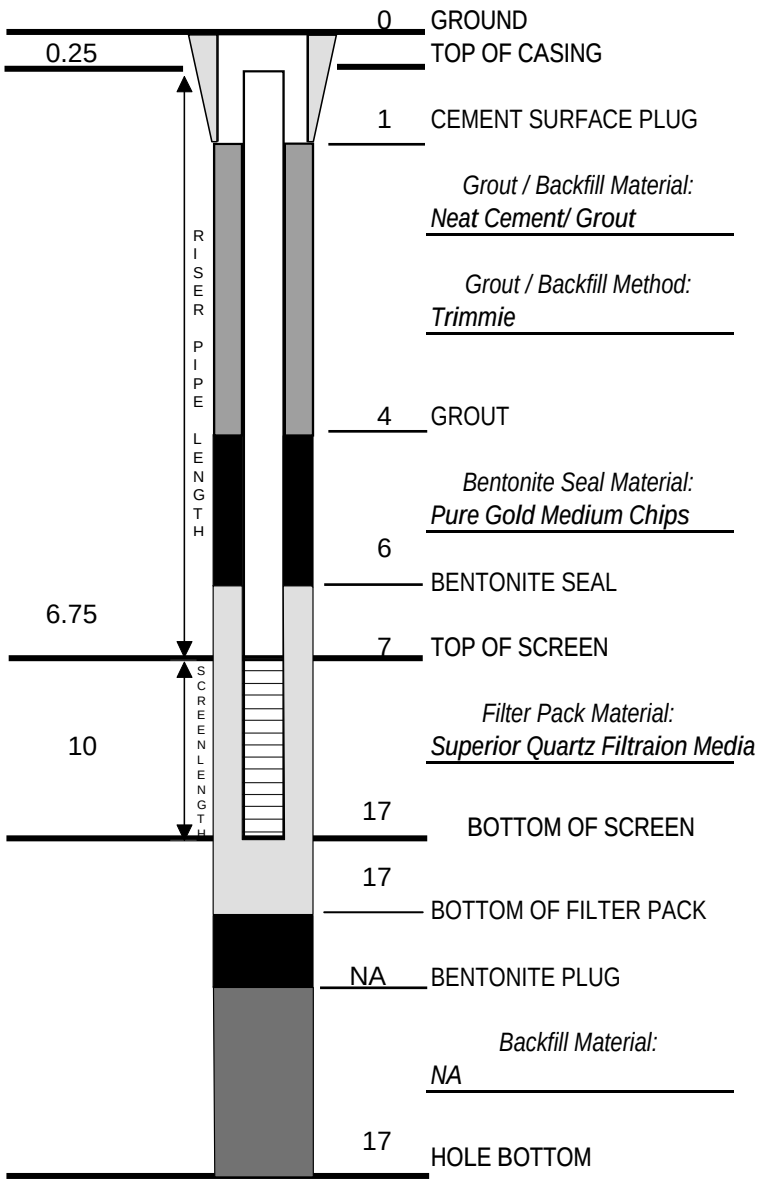
SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:	Firm: Grand Rapids 2025 E. Beltline Ave. Ste 402 Grand Rapids, MI	616-975-5415 Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM BELOW GROUND		SHEET of	
		DATE: 6/7/06	
PROJECT: L.E. Carpenter		PROJECT NO: 6527.23	
LOCATION: North side of Ross St.	WELL NUMBER: MW- 19-12	DATE INSTALLED: June 7, 2006	
OBSV. BY: E. Vincke	CHECKED BY:	SIGNED:	

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 0.5 bags
3" sump on bottom of screen

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 17 Ft.
____ In. from ____ To ____ Ft.

F) Surf. Casing Diameter
8 In. from 0 To 1 Ft.
2nd Surf. Casing:
____ In. from ____ To ____ Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 0.8 Hrs.

C) Water: Removed: 35
Added: 30

D) Water Clarity Before / After Development:
Before: V. Trub., Dark Gray Brown
After: Clear, Clear

F) Odor (Describe if present): None

3. WATER LEVEL SUMMARY:

A) After Developing: 7.5 Ft. Below Top of Casing

B) Other Date / Time: 6/19/06 7.82 Ft.
Other Date / Time: ____ Ft.

MONITOR WELL INSTALLATION

Client: L. E. CARPENTER Job No: 3600-05-67 Date Drilled: 5/22/91 Well No: MW-21

Site: WHARTON, NJ Interval: 5-15 FT Top of Steel Casing: _____

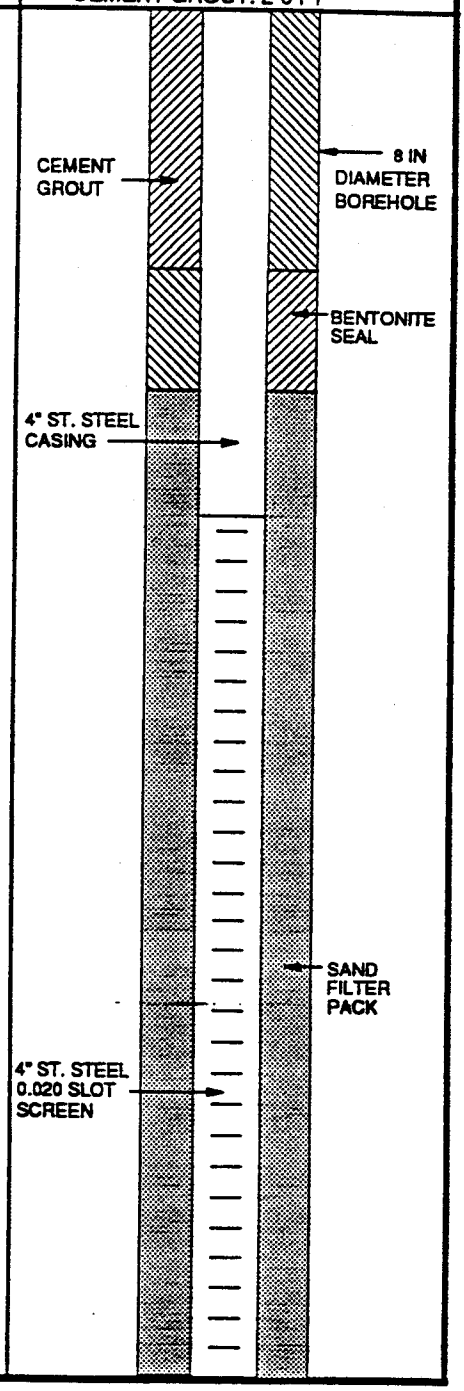
Total Depth: 15.0 FT Casing Size & Type: 4" ST. STEEL Screen Size: 0.020

Comments: _____

Depth	Blow Count	Sample Description
1	28	75% RECOVERY. 0-6" DARK BROWN TOPSOIL/ HUMUS. 6-24 YELLOW-BRN MOTTLED STIFF CLAY.
	20	
	18	
2	32	
	.	0% RECOVERY.
	.	
3	14	
	7	
4	9	
	14	10% RECOVERY. BROWN FINE GRAINED CLAY-RICH SAND WITH BLACK STAINING. DAMP. HNU=NR
5	6	
	7	
6	20	WATER AT 6 FT
	45	25% RECOVERY. GREY, VERY STIFF CLAY WITH SMALL, ROUNDED PEBBLES. HNU=1/2 UNIT ABOVE BG.
7	17	
	50	
8	75	
	66	25% RECOVERY. GREY, VERY STIFF CLAY WITH MOTTLING. HNU=BG.
9	16	
	65	
10	88	
	105	

Completion Data

SCREEN: 15-5 FT
SAND FILTER PACK: 15-3 FT
BENTONITE SEAL: 3-2 FT
CEMENT GROUT: 2-0 FT



MONITOR WELL INSTALLATION

Client: L. E. CARPENTER Job No: 3600-05-67 Date Drilled: 5/22/91 Well No: MW-21

Site: WHARTON, NJ Interval: 5-15 FT Top of Steel Casing: _____

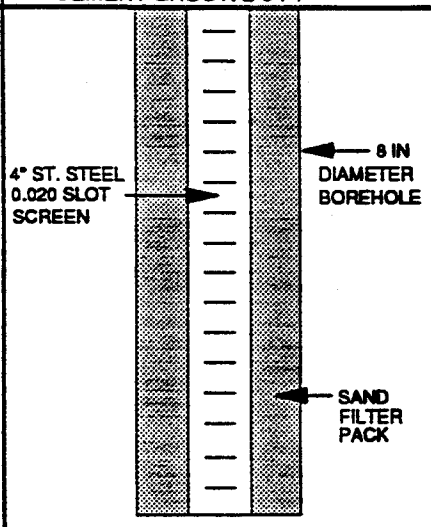
Total Depth: 15.0 FT Casing Size & Type: 4" ST. STEEL Screen Size: 0.020

Comments: _____

Depth	Blow Count	Sample Description
12	21	100% RECOVERY. 0-12" BROWN, WELL-SORTED FINE G. SAND. 12-24" BROWN, WELL SORTED COARSE G. SAND.
	6	
	5	EXHIBITS DOWNWARD COARSENING
13	50	
	43	
14	47	100% RECOVERY. BROWN, WELL-SORTED COARSE G. SAND COARSENING INTO GRAVEL
	52	
15	80	TD = 15.0 FT
16		MATERIALS: 10 FT 0.020 SLOT ST. STEEL 4" SCREEN 10 FT ST. STEEL 4" CASING 1 BUCKET BENTONITE PELLETS
17		
18		
19		
20		
21		

Completion Data

SCREEN: 15-5 FT
SAND FILTER PACK: 15-3 FT
BENTONITE SEAL: 3-2 FT
CEMENT GROUT: 2-0 FT



WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-27s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/7/06	6/7/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	15.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 6/8/06 00:00 ▼ Depth (ft bgs) 6.05

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Topsoil**- mostly very fine sand, some silt, organic, dry, loose, very dark gray (2.5Y3/1).				.1	
1 CS	57			**Sand**- mostly very fine sand, little fine sand and clay, trace coarse sand, loose, no odor, dry, dark yellow brown (10YR4/6).	SP				
				Fill- mostly fine sand, some medium sand, little coarse sand, dry, loose, no odor, black (10YR2/1).				2	
			5	▼					
2 CS	63			**Sand**- mostly very fine sand, some clay, trace cobble, wet, no odor, nonplastic, loose, black (10YR2/1).	SP			4.1	
				Sand- mostly medium sand, some fine and coarse sand, little gravel, trace cobble, moist, loose, no odor, dark yellow brown (10YR4/6).	SW			3.8	
			10	Large cobble with broken stone and dust.					
3 CS	58			**Sand**- mostly very fine sand, some clay and silt, little cobbles and gravel, nonplastic, no odor, moist, dark gray (2.5Y3/1).	SP			.8	
4 CS	100			**Sand**- mostly very fine sand, some silt and clay, trace coarse sand and gravel, wet, loose, no odor, low plasticity, light olive brown (2.5 Y5/3).	SP			0	
			15	End of Boring 15.0'.				0	
			20						
			25						

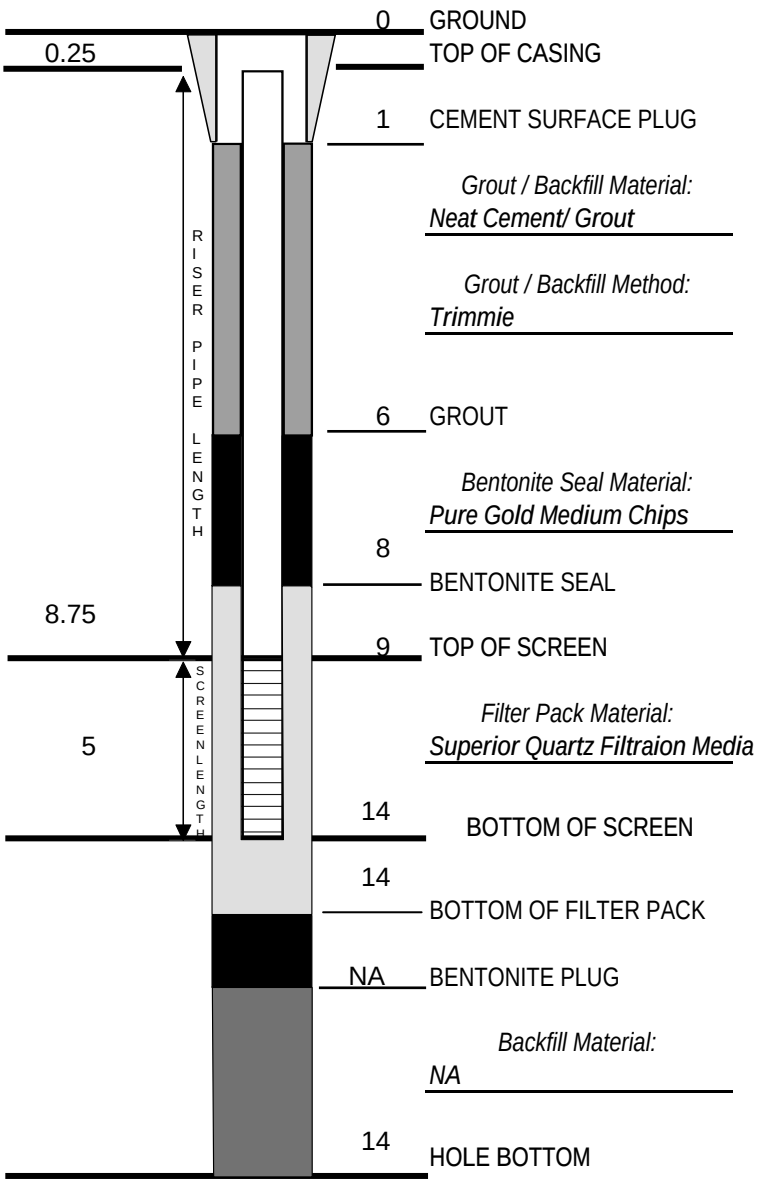
SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:	Firm: Grand Rapids 2025 E. Beltline Ave. Ste 402 Grand Rapids, MI	616-975-5415 Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM BELOW GROUND		SHEET of
		DATE: 6/7/06
PROJECT: L.E. Carpenter		PROJECT NO: 6527.23
LOCATION: Background Well by Main St.	WELL NUMBER: MW- 27s	DATE INSTALLED: June 7, 2006
OBSV. BY: E. Vincke	CHECKED BY:	SIGNED:

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



Grout / Backfill Material: *Neat Cement/ Grout*

Grout / Backfill Method: *Trimmie*

Bentonite Seal Material: *Pure Gold Medium Chips*

Filter Pack Material: *Superior Quartz Filtraion Media*

Backfill Material: *NA*

NOTES:
Sand- 2 bags
Holeplug- 0.75 bags
3" sump on bottom of screen

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 14 Ft.
___ In. from ___ To ___ Ft.

F) Surf. Casing Diameter
8 In. from 0 To 1 Ft.
2nd Surf. Casing:
___ In. from ___ To ___ Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 0.8 Hrs.

C) Water: Removed: 10
Added: 20

D) Water Clarity Before / After Development:
Before: V. Trub., Yellowish Brown
After: V. Trub., Yellowish Brown

F) Odor (Describe if present):

3. WATER LEVEL SUMMARY:

A) After Developing: 6.3 Ft. Below Top of Casing

B) Other Date / Time: 6/19/06 8.59 Ft.
Other Date / Time: ___ Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-28s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	15.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 6/8/06 00:00 ▼ Depth (ft bgs) 2.02

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	72		0	**Sand**- mostly very fine sand, little coarse sand and gravel, some silt and clay, loose, wet, no odor, very dark gray brown (10YR3/2).	SP				
				Fill- mostly very fine sand, little coarse sand and gravel, few clay, trace medium sand and cobble, moist, chemical odor, nonplastic, dark gray (5Y4/1).				10	Slurry Monolith, hard drilling.
2 CS	57		5	Slough from top 18.0".				20	
				Sand- mostly very fine sand, little coarse sand and gravel, few clay, trace medium sand and cobble, wet, chemical odor, nonplastic, dark gray (5Y4/1).	SW			40	
3 CS	43		10	**Sand**- mostly medium sand, some coarse sand and gravel, little fine sand, trace cobbles, loose, saturated, chemical odor, dark olive gray (5Y3/2).	SW			50	
								90	
			15	End of Boring 15.0'.					
			20						
			25						

SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:

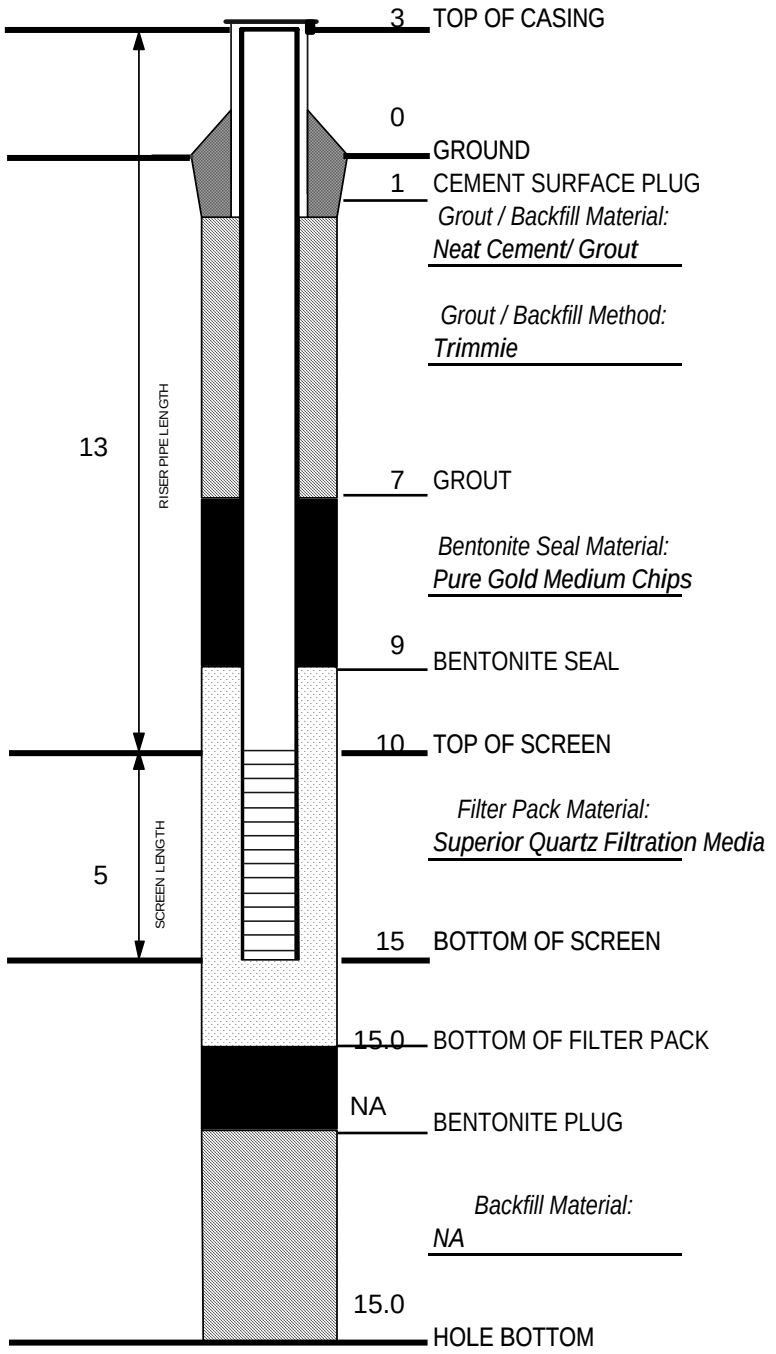
Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI

616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM ABOVE GROUND			SHEET of	
			DATE: 6/6/06	
PROJECT: L.E. Carpenter			PROJECT NO: 6527.23	
LOCATION: Middle of site	WELL NUMBER:	MW- 28s	DATE INSTALLED:	June 06, 2006
OBSV. BY: E. Vincke	CHECKED BY:	J. Dexter	SIGNED:	

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 0.5 bags
3" sump on bottom of screen.

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 15.0 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 1 Hrs.

C) Water: Removed: 50
Added: 20

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Clear, Clear

F) Odor (Describe if present): Yes, (very Strong)

3. WATER LEVEL SUMMARY:

A) Before Developing: 5.02 Ft. Below Top of Casing

B) After Developing: 6/19/06 5.52 Ft.
Other Date / Time: Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-28i

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	20.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time — Depth (ft bgs) After Drilling: Date/Time 6/8/06 00:00 ▼ Depth (ft bgs) 1.9

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	98		0	**Sand**- mostly very fine sand, little coarse sand and gravel, some silt and clay, loose, wet, no odor, very dark gray brown (10YR3/2).	SP			0.7	
				Fill- mostly very fine sand, little coarse sand and gravel, few clay, trace medium sand and cobble, moist, chemical odor, nonplastic, dark gray (5Y4/1).				8.6 16.5 70.3 120	Slurry Monolith, hard drilling.
2 CS	73		5	Slough from 0-2' bgs zone.				62.4	
				Sand- mostly very fine sand, little coarse sand and gravel, few clay, trace medium sand and cobble, wet, chemical odor, nonplastic, dark gray (5Y4/1).	SW			32.6 250 3460	
3 CS	37		10	**Sand**- mostly medium sand, some coarse sand and gravel, little fine sand, trace cobbles, loose, saturated, chemical odor, dark olive gray (5Y3/2).	SW			180 35 60 32	
4 CS	7		15	**Sand**- mostly fine sand, some medium sand, little coarse sand and gravel, trace cobbles, loose, saturated, no odor.	SW			28.4	
			20	End of Boring 20.0'.					
			25						

SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/18/08

Signature:

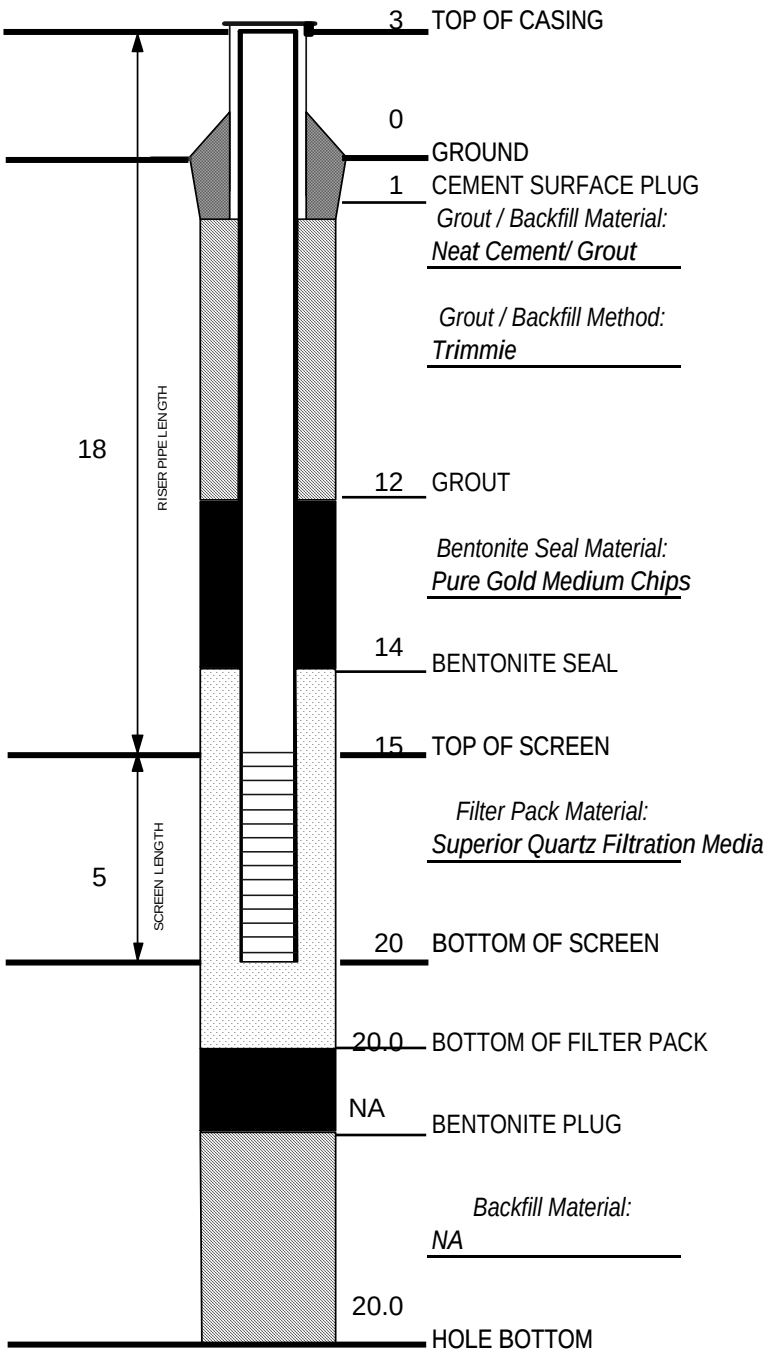
Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI

616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM ABOVE GROUND				SHEET of	
				DATE: 6/6/06	
PROJECT:	L.E. Carpenter			PROJECT NO: 6527.23	
LOCATION:	Middle of site	WELL NUMBER:	MW- 28i	DATE INSTALLED:	June 06, 2006
OBSV. BY:	E. Vincke	CHECKED BY:	J. Dexter	SIGNED:	

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 0.5 bags
3" sump on bottom of screen.

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 20.0 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 1 Hrs.

C) Water: Removed: 50
Added: 30

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Clear, Clear

F) Odor (Describe if present): None

3. WATER LEVEL SUMMARY:

A) Before Developing: 4.90 Ft. Below Top of Casing

B) After Developing: 6/19/06 5.35 Ft.
Other Date / Time: Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-29s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	13.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time 6/6/06 00:00 ▽ Depth (ft bgs) 7.5 After Drilling: Date/Time 6/7/06 00:00 ▼ Depth (ft bgs) 3.9

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	Asphalt					
1 CS	65			**Sand**- mostly fine sand, some very fine sand, little silt, trace coarse sand and cobble, moist, no odor, loose, yellow brown (10YR5/4).	SW			0	
				Silt- mostly silt, little clay, few fine sand, trace, gravels and cobbles, moist, non plastic, no odor, black (10YR2/1). ▼	ML			0	
			5					.4	
2 CS	83							.7	
				▽ **Sand**- mostly fine sand, some medium sand, trace coarse sand, gravel, cobble, and clay, moist loose, no odor, dark gray (2.5YR4/1).	SW			.7	
3 CS	90		10	**Sand**- mostly fine sand, some medium sand, little silt, gravel, cobble, trace coarse sand and clay, wet, loose, no odor, nonplastic, light olive brown (2.5YR5/3).	SW			.7 .6	
								.7	
				End of Boring 13.0".					
			15						
			20						
			25						

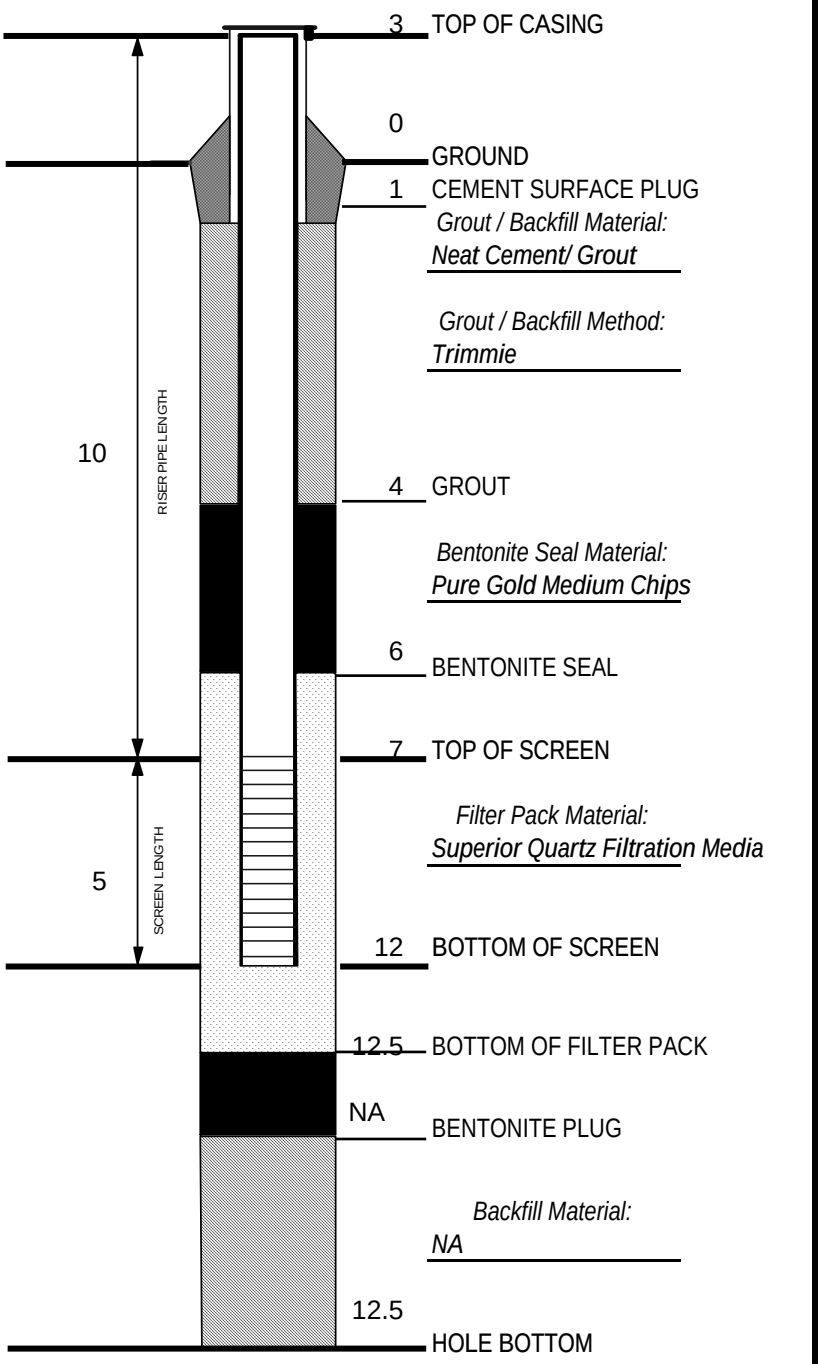
SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:	Firm: Grand Rapids 2025 E. Beltline Ave. Ste 402 Grand Rapids, MI	616-975-5415 Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM ABOVE GROUND			SHEET of	
			DATE: 6/6/06	
PROJECT:	L.E. Carpenter		PROJECT NO: 6527.23	
LOCATION:	Along drainage ditch	WELL NUMBER:	MW- 29s	DATE INSTALLED: June 06, 2006
OBSV. BY:	E. Vincke	CHECKED BY:	J. Dexter	SIGNED:

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 0.75 bags
3" sump on bottom of screen.

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Pipe Schedule: Type 304 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 12.5 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 1 Hrs.

C) Water: Removed: 50
Added: 30

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Cloudy, Clear- Cloudy

F) Odor (Describe if present): None

3. WATER LEVEL SUMMARY:

A) Before Developing: 6.90 Ft. Below Top of Casing

B) After Developing: 6/19/06 7.15 Ft.
Other Date / Time: Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-30s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	10.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 6/7/06 00:00 Depth (ft bgs) -.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	100		0	**Sand**- mostly very fine sand, little medium sand, some clay, saturated, soft, nonplastic, no odor, very dark gray (2.5YR3/1).	SW			43	Slurry Monolith, hard drilling.
				Fill- mostly cobbles, some medium sand, little coarse sand and gravel, dry, chemical odor, loose.				67	
								71	
2 CS			5	**Sand**- mostly medium sand, some coarse sand, little gravel, loose, saturated, cobbles, no odor.	SW			120	
								86	
			10	End of Boring 10.0'.					
			15						
			20						
			25						

SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI

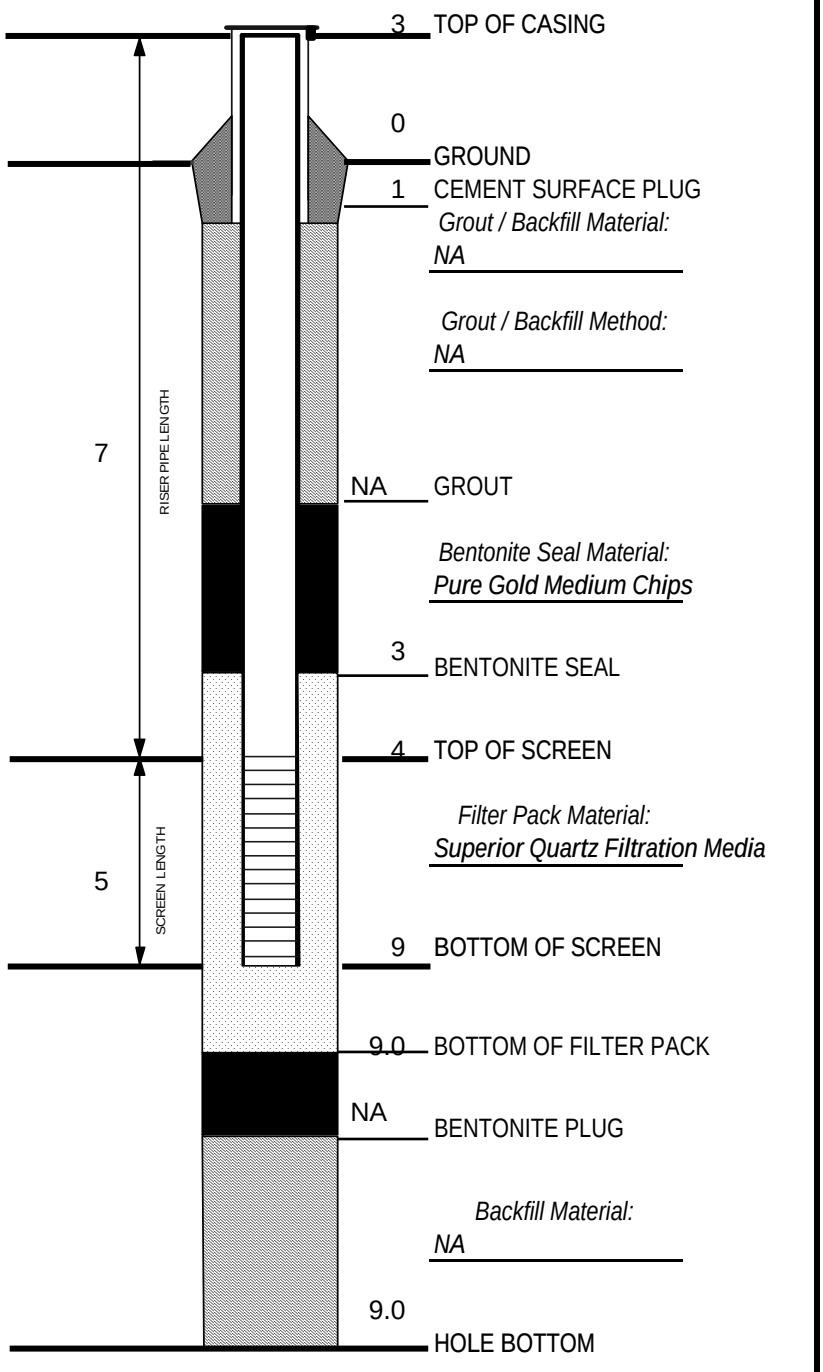
616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM
ABOVE GROUND

SHEET			of		
DATE:	6/6/06				
PROJECT:	L.E. Carpenter		PROJECT NO: 6527.23		
LOCATION:	Along drainage ditch	WELL NUMBER:	MW- 30s	DATE INSTALLED:	June 06, 2006
OBSV. BY:	E. Vincke	CHECKED BY:	J. Dexter	SIGNED:	

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 1.5 bags
3" sump on bottom of screen.

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 9.0 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 0.8 Hrs.

C) Water: Removed: 35
Added: 10

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Cloudy, Cloudy

F) Odor (Describe if present): Yes (strong)

3. WATER LEVEL SUMMARY:

A) Before Developing: 2.33 Ft. Below Top of Casing

B) After Developing: 6/19/06 2.68 Ft.
Other Date / Time: Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW30i

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	15.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time 6/6/06 00:00 ▽ Depth (ft bgs) 5 After Drilling: Date/Time 6/7/06 00:00 ▼ Depth (ft bgs) -.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	79		0	**Sand**- mostly very fine sand, little medium sand, some clay, saturated, soft, nonplastic, no odor, very dark gray (2.5YR3/1).	SW			30	Slurry Monolith, hard drilling.
				Fill- mostly fine sand, some medium and coarse sand, little gravel, few cobbles, dry, loose, chemical odor, light gray (10YR7/1) with a 6" very pale brown (10YR7/3) seem through the middle.				70	
								61	
2 CS	71		5 ▽	**Sand**- mostly very fine sand, trace coarse sand, some silt and clay, trace cobble, nonplastic, very slight odor, wet, soft, organic material, dark gray brown (10YR4/2).	SP			10	
								9	
3 CS	10		10	**Sand**- mostly fine sand, little gravel and clay, trace cobbles, coarse and medium sand, saturated, loose, nonplastic, very slight odor, dark green gray (Gley1 4/1).	SW			9	
			15	End of Boring 15.0'.					
			20						
			25						

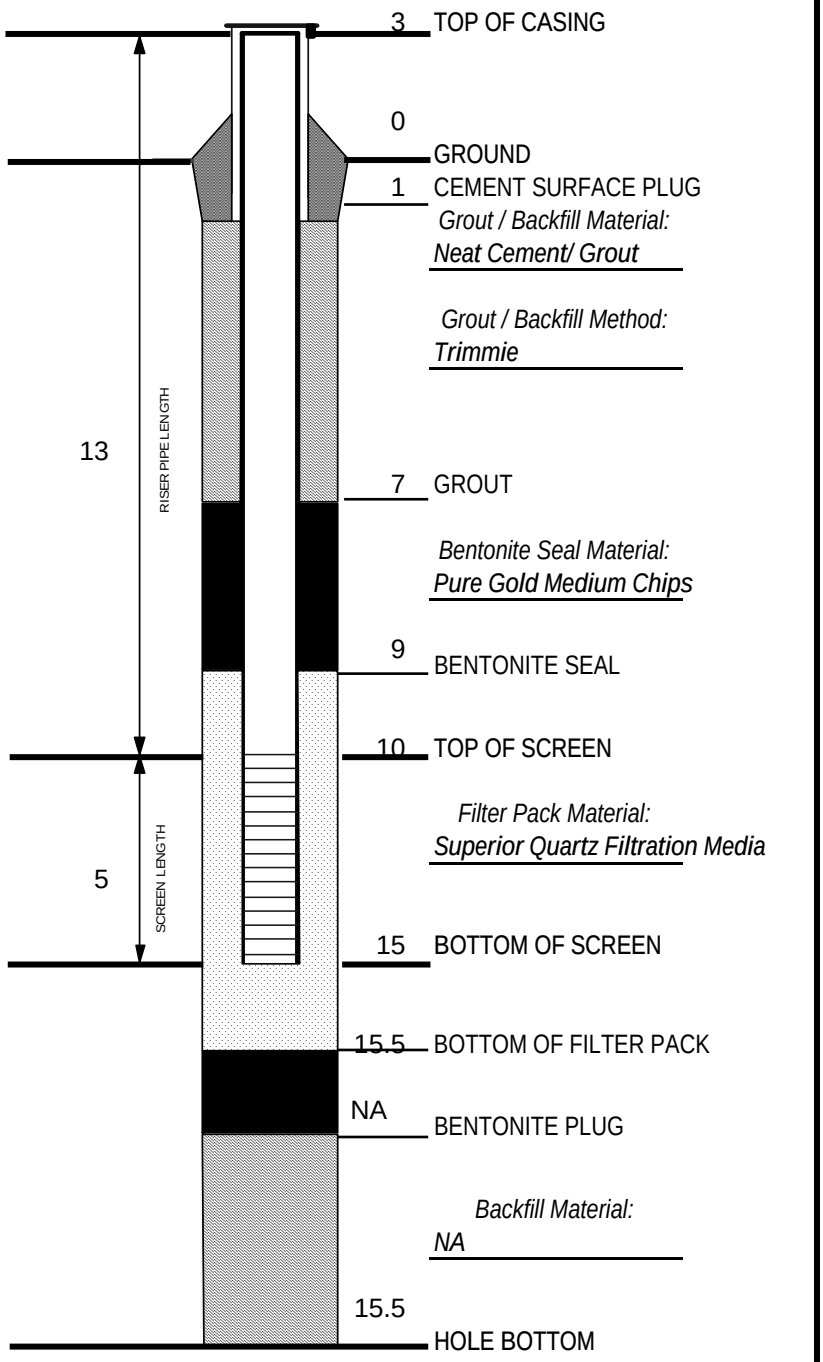
SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:	Firm: Grand Rapids 2025 E. Beltline Ave. Ste 402 Grand Rapids, MI	616-975-5415 Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM ABOVE GROUND				SHEET of	
				DATE: 6/6/06	
PROJECT:	L.E. Carpenter			PROJECT NO: 6527.23	
LOCATION:	Along drainage ditch	WELL NUMBER:	MW- 30i	DATE INSTALLED:	June 06, 2006
OBSV. BY:	E. Vincke	CHECKED BY:	J. Dexter	SIGNED:	

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



NOTES:
Sand- 2 bags
Holeplug- 0.5 bags
3" sump on bottom of screen.

1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 15.5 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 0.8 Hrs.

C) Water: Removed: 35
Added: 30

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Clear, Clear

F) Odor (Describe if present): None

3. WATER LEVEL SUMMARY:

A) Before Developing: 2.32 Ft. Below Top of Casing

B) After Developing: 6/19/06 2.66 Ft.
Other Date / Time: Ft.

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-30d

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter	6/6/06	6/6/06	6527.23

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	25.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - E. Vincke Driller - J. Drabek	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	NJ	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 6/7/06 00:00 Depth (ft bgs) -.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	94		0	**Sand**- mostly very fine sand, little medium sand, some clay, saturated, soft, nonplastic, no odor, very dark gray (2.5YR3/1).	SW			0.5	
				Fill- mostly cobbles, some medium sand, little coarse sand and gravel, dry, chemical odor, loose.				40.2 86.5	Slurry Monolith, hard drilling.
2 CS	7		5	**Sand**- mostly very fine sand, little coarse sand, some silt and clay, saturated, very slight odor, soft, loose.	SW			3.4	
3 CS	25		10	**Sand**- mostly medium sand, some coarse sand, little gravel, loose, saturated, cobbles, no odor.	SW			0	
4 CS	0		15	No Recovery					
5 CS	12		20	**Sand**- mostly medium sand, some coarse sand, little gravel, loose, saturated, cobbles, no odor.	SW			0	
			25	End of boring 25.0'.					

SOIL BORING WELL CONSTRUCTION LOG 6-6-06.GPJ RMT_CORP.GDT 8/6/08

Signature:

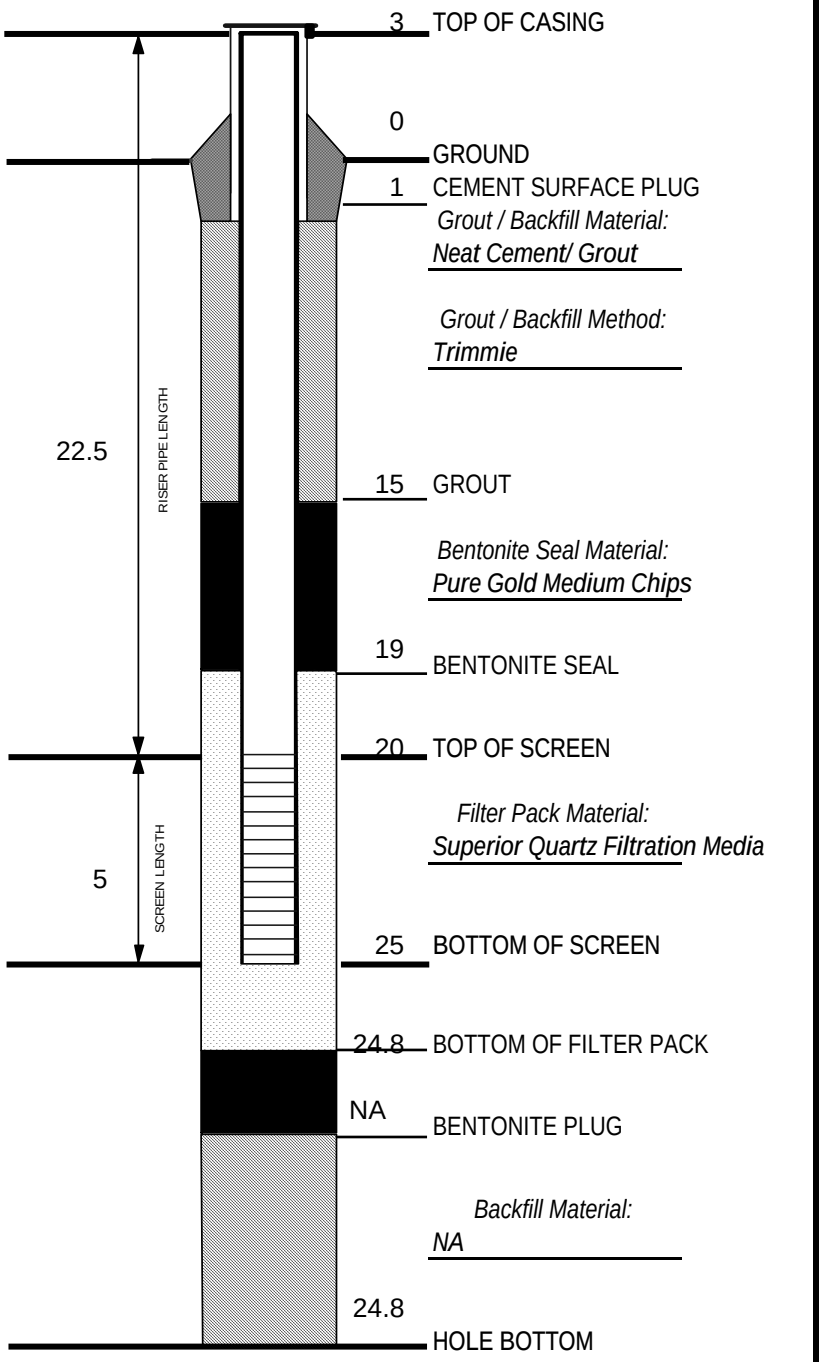
Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI

616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION DIAGRAM ABOVE GROUND			SHEET of
			DATE: 6/6/06
PROJECT: L.E. Carpenter			PROJECT NO: 6527.23
LOCATION: Along drainage ditch	WELL NUMBER:	MW- 30d	DATE INSTALLED: June 06, 2006
OBSV. BY: E. Vincke	CHECKED BY:	J. Dexter	SIGNED:

ELEVATION (BENCHMARK: USGS)	DISTANCE BELOW OR ABOVE GROUND (FT.)



1. CASING AND SCREEN DETAILS:

A) Type of pipe: SS Type 304 Pipe Schedule: 10s

B) Pipe Joints: Threaded O-Ring

C) Solvent Used? None

D) Screen Type: SS Screen Slot Size: 0.01

E) Borehole Diameter:
6 In. from 0 To 24.8 Ft.
In. from To Ft.

F) Surf. Casing Diameter
5 In. from 3 To -2 Ft.
2nd Surf. Casing:
In. from To Ft.

G) Installed Protective Cover w/Lock? Yes

2. WELL DEVELOPMENT:

A) Method: Purge and Surge

B) Time spent developing: 0.5 Hrs.

C) Water: Removed: 35
Added: 50

D) Water Clarity Before / After Development:
Before: V. Turb, Dark Gray Brown
After: Clear, Clear

F) Odor (Describe if present): None

3. WATER LEVEL SUMMARY:

A) Before Developing: 2.32 Ft. Below Top of Casing

B) After Developing: 6/19/06 2.70 Ft.
Other Date / Time: Ft.

NOTES:
Sand- 2 bags
Holeplug- 0.5 bags
3" sump on bottom of screen.

WELL CONSTRUCTION LOG

WELL NO. MW-31s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter & Co. PRMP Wetland Monitoring Well Install	4/8/08	4/8/08	6527.32

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	9.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - J. Overvoorde Driller - Frank, Marshall	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	New Jersey	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 4/9/08 00:00 ▼ Depth (ft bgs) 4.55

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Fill**- manmade organic topsoil.					
				Fill- 2" minus gravel.					
			1						
			2						
			3	**Topsoil**- organic topsoil, dark yellowish brown (10YR4/4), loose, moist.					
				Fill- mostly fine sand and silt, some medium and coarse sand, little gravel, trace cobble, mild plasticity, no odor, loose, moist, dark brown- black (10YR3/3).					
			4	▼				1.9	
			5						
1 CS	90								
			6	**Fill**- mostly gravel with fine-coarse sand matrix, some good sized cobble, trace rock, moist, no odor, loose.				1.9	
			7						
				Clay- silty clay with sand and gravel, medium density, slight odor, wet, plastic, trace cobble.					
			8		CL-ML				
2 CS	100							25.3	
			9	End of boring 9' bgs.					

SOIL BORING WELL CONSTRUCTION LOG APRIL 2008 MW INSTALL.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids 616-975-5415
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI 49546 Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION LOG

WELL NO. MW-32s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter & Co. PRMP Wetland Monitoring Well Install	4/7/08	4/7/08	6527.32

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	9.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - J. Overvoorde Driller - Frank, Marshall	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	New Jersey	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 4/9/08 00:00 ▼ Depth (ft bgs) 5.32

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Fill**- manmade organic topsoil.					
				Fill- 2" minus gravel.					
			1						
			2						
			3	**Topsoil**- orgainc topsoil.				0.2	
			4	**Fill**- sandy silt, fine- coarse grain with little gravel, dark brown (10YR3/3), loose, moist, no odor, trace cobbles.					
			5	▼					
1 CS	60			**Clay**- dense, plastic, gray (7.5YR5/1), trace sand and gravel, moist to wet, no odor, trace cobble.				0.6	
			6		CL				
			7					46.5	
			8	**Clay**- with trace sand, trace cobble/ rock, moderately dense, plastic, wet, slight odor, black (7.5YR2.5/1).					
2 CS	50				CL			57.7	
			9	End of boring 9' bgs.					

SOIL BORING WELL CONSTRUCTION LOG APRIL 2008 MW INSTALL.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI 49546
616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-33s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter & Co. PRMP Wetland Monitoring Well Install	4/8/08	4/8/08	6527.32

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	9.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - J. Overvoorde Driller - Frank, Marshall	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	New Jersey	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 4/9/08 00:00 ▼ Depth (ft bgs) 5.78

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Fill**- manmade organic topsoil.					
				Fill- 2" minus gravel.					
			1						
			2						
			3	**Topsoil**- organic, wet, loose.					
			4	**Fill**- sandy silt, fine- coarse grain, little gravel, trace cobble, moist, no odor, compact.				0.3	
1 CS			5						
			6	▼					
			7	**Fill**- sandy gravel, fine- coarse grain, loose, moist- wet, slight odor, trace rock, some silt, very dark gray (10YR3/1).				3.9	
2 CS			8	**Clay**- with trace sand, moderately dense, plastic, wet, no odor, trace cobble and rock, (7.5YR2.5/1).	CL				
			9	End of boring 9' bgs.				1.6	

SOIL BORING WELL CONSTRUCTION LOG APRIL 2008 MW INSTALL.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI 49546
616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION LOG

WELL NO. MW-34s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter & Co. PRMP Wetland Monitoring Well Install	4/7/08	4/7/08	6527.32

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	9.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - J. Overvoorde Driller - Frank, Marshall	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	New Jersey	While Drilling: Date/Time — Depth (ft bgs) After Drilling: Date/Time 4/9/08 00:00 ▼ Depth (ft bgs) 7.01

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Fill**- manmade organic topsoil.					
				Fill- 2" minus gravel.					
			1						
			2						
			3	**Topsoil**- organic.				1.3	
			4	**Fill**- sandy silt, fine- coarse sand, little gravel, trace cobble, loose, moist, no odor, dark brown (10YR3/3).					
1 CS			5					3.0	
			6	**Clay**- dense, plastic, little sand, moist to wet, trace cobble, very dark gray (10YR3/1), no odor.					
			7	▼	CL				
			8	Size and amount of gravel and rock increase, slight odor.				3.7	
2 CS				**Clay**- sandy silty clay with gravel, wet, no odor, compact, brown (10YR4/3).	CL				
			9	End of boring 9' bgs.					

SOIL BORING WELL CONSTRUCTION LOG APRIL 2008 MW INSTALL.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI 49546
616-975-5415
Fax 616-975-1098

Checked By: J. Dexter

WELL CONSTRUCTION LOG

RMT INC.

WELL NO. MW-35s

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
L.E. Carpenter & Co. PRMP Wetland Monitoring Well Install	4/7/08	4/7/08	6527.32

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Boart Longyear	Rotosonic		---	9.0	6

Boring Location:	Personnel	Drilling Equipment:
	Logged By - J. Overvoorde Driller - Frank, Marshall	Minisonic

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Wharton	Morris	New Jersey	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time 4/9/08 00:00 ▼ Depth (ft bgs) 5.85

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**Fill**- manmade organic topsoil.					
				Fill- 2" minus gravel.					
			1						
			2						
			3	**Topsoil**- organic.					
				Fill- sandy silt, fine-coarse grain, little gravel, trace cobble, no odor, loose, little plasticity, moist, dark brown (10YR3/3).				1.9	
			4						
			5						
1 CS	80			▼				1.2	
			6						
				Color change to brown (10YR5/3), gravel size and content increases.					
			7						
				Clay- dense, plastic, some organics, moist to wet, trace cobble, very dark gray (10YR3/1), strong odor (ex. sharpie marker).				139	
			8		CL				
2 CS	100							399	
			9	End of boring 9' bgs.					

SOIL BORING WELL CONSTRUCTION LOG APRIL 2008 MW INSTALL.GPJ RMT_CORP.GDT 8/6/08

Signature:

Firm: Grand Rapids 616-975-5415
2025 E. Beltline Ave. Ste 402 Grand Rapids, MI 49546 Fax 616-975-1098

Checked By: J. Dexter

Appendix D
DEHP Biodegradation Articles

ELSEVIER

Chemosphere 55 (2004) 533–538

CHEMOSPHERE

www.elsevier.com/locate/chemosphere

Biodegradation of phthalate esters by two bacteria strains

B.V. Chang [a,*], C.M. Yang [a], C.H. Cheng [b], S.Y. Yuan [a]

[a] *Department of Microbiology, Soochow University, Shih Lin, Taipei 111, Taiwan*
[b] *Department of Veterinary Medicine, National Taiwan University, Taipei 106, Taiwan*

Received 14 April 2003; received in revised form 20 October 2003; accepted 25 November 2003

Abstract

In this study two aerobic phthalic acid ester (PAE) degrading bacteria strains, DK4 and O18, were isolated from river sediment and petrochemical sludge, respectively. The two strains were found to rapidly degrade PAE with shorter alkyl-chains such diethyl phthalate (DEP), dipropyl phthalate (DPrP), di-*n*-butyl phthalate (DBP), benzylbutyl phthalate (BBP) and diphenyl phthalate (DPP) are very easily biodegraded, while PAE with longer alkyl-chains such as dicyclohexyl phthalate (DCP) and dihexyl phthalate (DHP) and di-(2-ethylhexyl) phthalate (DEHP) are poorly degraded. The degradation rates of the eight PAEs were higher for strain DK4 than for strain O18. In the simultaneous presence of strains DK4 and O18, the degradation rates of the eight PAEs examined were enhanced. When the eight PAEs were present simultaneously, degradation rates were also enhanced. We also found that PAE degradation was delayed by the addition of nonylphenol or selected polycyclic aromatic hydrocarbons (PAHs) at a concentration of 1 μg/g in the sediment. The bacteria strains isolated, DK4 and O18, were identified as *Sphigomonas* sp. and *Corynebacterium* sp., respectively.

Keywords: Phthalic acid esters; Aerobic degradation; Nonylphenol; PAHs

1. Introduction

Phthalic acid esters (PAEs) are a class of refractory organic compounds widely used as plasticizers in polyvinyl chloride plastics. They are characterized by low solubility in water and high octanol/water partition coefficients. With increasing alkyl chain length, the log K_{ow} increases indicating greater hydrophobicity. The log K_{ow} values for diethyl phthalate (DEP), di-*n*-butyl phthalate (DBP), benzylbutyl phthalate (BBP), and di-(2-ethylhexyl) phthalate (DEHP) were 2.38, 4.45, 4.59 and 7.94 (Staples et al., 1997). They are among the most commonly used industrial chemicals and have become widespread in the environment; they have been found in sediments, natural waters, soils, and aquatic organisms (Giam et al., 1984; Staples et al., 1997). As a result of both the large quantities produced and their widespread distribution, PAE have become ubiquitous environmental pollutants. Some of them are suspected mutagens and carcinogens (Huff and Kluwe, 1984).

Metabolic breakdown of PAE by microorganisms is considered to be one of the major routes of environmental degradation for these widespread pollutants. A number of studies have demonstrated the degradation of several PAE under aerobic conditions in soil, natural water and wastewater (Inman et al., 1984; Shanker et al., 1985; Jianlong et al., 1996). Microorganisms that degrade PAE can be aerobic (Jianlong et al., 1995), anaerobic (Shelton et al., 1984), or facultative (Zhang and Peardon, 1990). Several PAEs are often simultaneously present in environment (Ejlertsson et al., 1996; Yuan et al., 2002); however, there is a surprising lack of information on the degradation process when PAE are simultaneously present.

*Corresponding author. Tel.: +886-2288-06628; fax: +886-2288-31193.
E-mail address: bvchang@mail.scu.edu.tw (B.V. Chang).

0045-6535/$ - see front matter © 2003 Elsevier Ltd. All rights reserved.
doi:10.1016/j.chemosphere.2003.11.057

The concentrations of eight PAEs in aquatic environments have been investigated previously and microbial degradation in river sediment samples collected from various sites in Taiwan has also been assessed (Yuan et al., 2002). The eight PAEs were DEP, dipropyl phthalate (DPrP), DBP, diphenyl phthalate (DPP), dicyclohexyl phthalate (DCP), dihexyl phthalate (DHP), BBP and DEHP. In the present study, two aerobic bacteria strains were isolated, which were recognized as having the potential to utilize PAE as a sole source of carbon; effect factors on biodegradation were then compared. We also assessed the effect of addition of nonylphenol or five polycyclic aromatic hydrocarbons (PAHs) on PAE degradation by strain DK4 in river sediment.

2. Materials and methods

2.1. Chemicals

DEP, DPrP, DBP, DPP, BBP, DCP, DHP and DEHP, all 99.0% analytical standards, were obtained from Chem Service (West Chester, PA) (Fig. 1). Nonylphenol and PAHs including phenanthrene, acenaphthene, anthracene, fluorene, and pyrene, 99.0% analytical standards were purchased from Aldrich Chemicals (Milwaukee, WI). Solvents were purchased from Mallinckrodt, Inc. (Paris, KY). All other chemicals were purchased from Sigma (St. Louis).

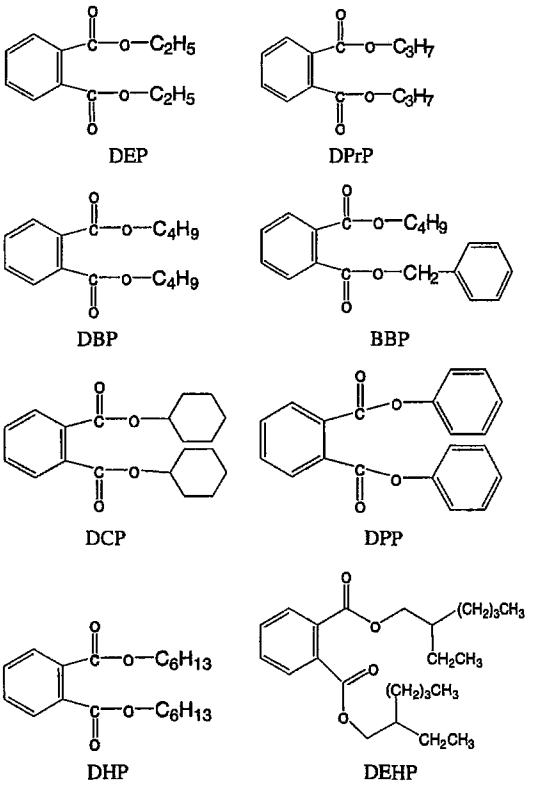


Fig. 1. A diagram of the chemical structures of the eight PAEs in this study.

2.2. Sampling, medium and culture conditions

Petrochemical sludge samples were collected from the Chinese Petroleum Corporation's refinery in Taoyuan, approximately 100 miles south of Taipei. Sediment samples were collected from Danshui Rivers. The site is considered to be among the most heavily contaminated in Taiwan (Yuan et al., 2002). Sediment samples (top 10 cm layer) were collected with an Ekman grab sampler and stored at 4 °C until used. All samples were collected between January and August 2000. The experimental medium used in the study comprised five components (in grams per litre distilled water): component A: K_2HPO_4 (21.75), KH_2PO_4 (8.5), $Na_2HPO_4 \cdot 12H_2O$ (44.6), NH_4Cl (1.7); component B: $CaCl_2$ (27.5); component C: $MgSO_4 \cdot 7H_2O$ (22.5), component D: $FeCl_3 \cdot 6H_2O$ (0.25). We collected 3 ml of each component, diluted it a second time in 1 l of distilled water and added at concentration of 5 mg/l for each of the eight PAEs. Pure cultures were obtained via repeated agar-broth dilution series. Stock cultures were kept at 4 °C in the dark and transferred every 3 months. Bacterial colonies successfully grown on basal media were purified and identified using a Biology GN System (Biology Co., USA).

2.3. Experimental design

Experiments were performed using 125 ml serum bottles containing 49 ml medium and 1 ml culture to which at concentration of 5 mg/l for each of the eight PAEs such as DEP, DPrP, DBP, DPP, BBP, DHP, DCP, and DEHP were added together. The following factors were manipulated to investigate their effects on PAE degradation: pH (5.0, 6.0, 7.0, 8.0 or 9.0); temperature (20, 30 or 40 °C); PAE concentration (5, 30, 100 mg/l); strain used (strains DK4 and O18 present individually or simultaneously); PAE present individually or simultaneously. The following factors were manipulated to investigate their effects on PAE degradation in Danshui river sediment: the presence of each of five PAHs (1 μg/g) and nonylphenol (1 μg/g). The initial concentration of PAEs was 5 mg/l and they were all present simultaneously. Sample bottles were incubated with shaking at 25 °C in darkness. Aqueous samples were periodically collected for the purpose of measuring residual concentrations of PAE present, pH, and OD_{600}. In addition, samples were incubated in BOD bottle and then measured DO value. All experiments were performed in triplicate.

The PAE degradation data collected during this experiment were found to fit well with first-order kinetics, $S = S_0 \exp(-k_1 t)$, $t_{1/2} = 0.693/k_1$, where S_0 is the initial concentration, S the substrate concentration, t equals time period, and k_1 represents the degradation rate constant. Remaining percentages of PAE were calculated as the residual concentration of PAE divided by the original concentration of PAE. Significant differences were calculated using a standard variance F-test.

2.4. Analytical methodology

PAE extraction and analysis were performed as described in Yuan et al. (2002). Two milliliters volume of samples were added to 2 ml *n*-hexane in sample bottles before shaking with a rotating shaker for 2 h at 160 rpm. Following removal of the initial *n*-hexane layer, the water was extracted with two additional *n*-hexane treatments. Extracts were analysed with a gas chromatograph (Hewlett-Packard 5890) equipped with an electron capture detector and DB-5 capillary column (film thickness, 0.25 μm; inner diameter, 0.25 mm; length, 30 m) (J.W., USA). The initial column temperature was set at 150 °C for 0.5 min, increased by 5 °C/min to 220 °C, then increased by 3 °C/min to 275 °C, where it was maintained for 13 min. Injector and detector temperatures were set at 250 and 320 °C, respectively. Nitrogen was used as both a carrier (flow rate 0.8 ml/min) and make-up (flow rate 60 ml/min) gas (20:1 split ratio). Recovery percentages were 92.5%, 89.1%, 96.5%, 90.5%, 93.5%, 90.1%, 98.1% and 97.5% for DEP, DPrP, DBP, DPP, BBP, DHP, DCP and DEHP, respectively. Detection limits were 100, 100, 100, 50, 50, 100, 100 and 100 μg/l, respectively.

3. Results and discussion

Pure strains were isolated from the sediment and sludge samples. Seven bacteria strains able to degrade eight PAEs aerobically were isolated from the sediment; one of these isolates, designated strain DK4 showed higher degradation rates. Strain DK4 was identified as *Corynebacterium* sp. The strain was gram-positive, rod-shaped, and formed pink colonies on tryptic soy agar. Six bacteria strains able to degrade eight PAEs were also isolated from the petrochemical sludge; one of these isolates, designated strain O18 had higher degradation rate. Strain O18 was identified as *Sphigomonas* sp. The strain was gram-negative, rod-shaped and formed yellow colonies on tryptic soy agar. The degradation abilities of strains DK4 and O18 were very stable and were retained after several generations of growth.

Comparison of eight PAEs degradation, DO values, pH values and OD_{600} value for strain DK4 are presented in Fig. 2. The remaining percentages of DEHP in our sterile control after a 7-day incubation period were 91.6%. The data indicate that DEHP degradation in river sediments are the result of microbial action. No lag phase was observed for strain DK4 and it was found to completely degrade the PAE, present at an initial concentration of 5 mg/l, within 7 days. The DO value was

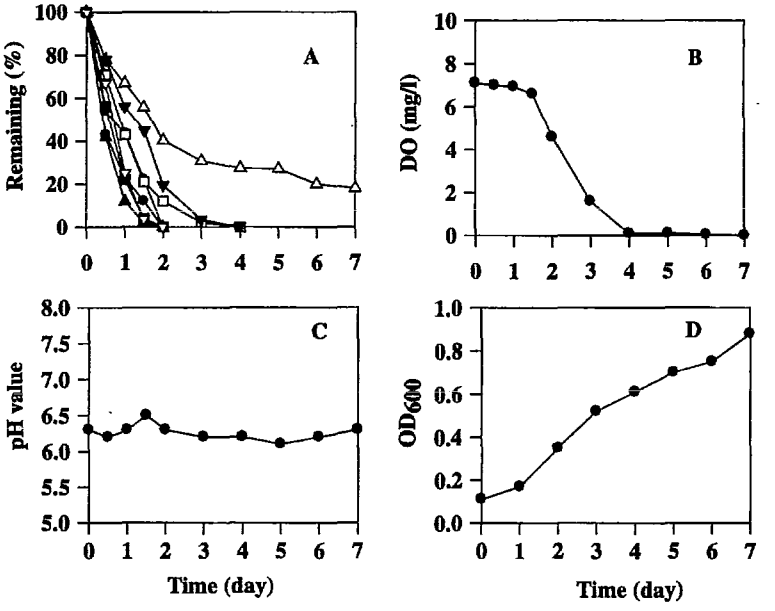


Fig. 2. Change in eight PAEs degradation (A), DO value (B), pH value (C) and OD_{600} value (D) on PAE degradation by strain DK4. Symbols: ●, DEP; ○, DPrP; ■, DBP; □, DHP; ▲, BBP; △, DEHP; ▼, DCP; ▽, DPP.

Table 1
Effects of change in temperature and pH value on PAE remaining percentages for strain DK4 within a 7-day incubation

Temperature (°C)	pH	Remaining percentage							
		DEP	DPrP	DBP	DHP	BBP	DEHP	DCP	DPP
30	7	ND[a]	ND[a]	ND[a]	ND[a]	ND[a]	10.8	ND[a]	ND[a]
20	7	ND[b]	ND[b]	ND[b]	ND[b]	ND[b]	22.8	ND[b]	ND[b]
40	7	ND[c]	ND[c]	ND[c]	ND[c]	ND[c]	29.2	ND[c]	ND[c]
30	5	2.1	3.7	1.2	12.4	3.4	45.8	21.2	1.2
30	6	ND[d]	ND[d]	ND[d]	5.3	ND[d]	33.8	12.4	ND[d]
30	8	ND[e]	ND[e]	ND[e]	ND[e]	ND[e]	15.8	ND[e]	ND[e]
30	9	ND[f]	ND[f]	ND[f]	6.3	ND[f]	35.8	15.3	ND[f]

[a] DEP, DPrP, DBP, DHP, BBP, DCP and DPP were completely degraded within 2, 2, 2, 4, 2, 4 and 2 days.
[b] DEP, DPrP, DBP, DHP, BBP, DCP and DPP were completely degraded within 3, 3, 3, 5, 3, 5 and 3 days.
[c] DEP, DPrP, DBP, DHP, BBP, DCP and DPP were completely degraded within 4, 3, 4, 5, 5, 6 and 4 days.
[d] DEP, DPrP, DBP, BBP, and DPP were completely degraded within 7, 7, 7, 6 and 7 days.
[e] DEP, DPrP, DBP, DHP, BBP, DCP and DPP were completely degraded within 2, 3, 2, 4, 3, 5 and 2 days.
[f] DEP, DPrP, DBP, BBP, and DPP were completely degraded within 6, 7, 6, 6 and 7 days.

initially 6.3, maintained for 2 days, and then decreased to ND within 4 days of starting the incubations. It may be PAE degrading bacteria depleted oxygen during growth. pH values ranged were measured from 6.1 to 6.5 within 7 days of incubation. D_{600} values were initially 0.11, and increased to 0.88 within 7 days of incubation. Plate counts of cell numbers ranged from 8.0×10^6 to 1.40×10^8 CFU/ml. This finding indicates the strain's ability to utilize PAE as carbon sources and energy source. Similar results were found for strain O18.

After a series of PAE degradation tests by strain DK4 at incubation temperatures ranging from 20 to 40 °C and pH values from 5.0 to 9.0. We found that optimal incubation conditions were determined as 30 °C and pH 7.0 (Table 1). The biodegradation of eight PAEs at various starting concentrations was shown in Table 2. We found that higher the concentration of PAE is, the more remaining percentages observed. We noted increases in microbial populations by strain DK4 from 8.0×10^6 to 1.4×10^8 CFU/ml for 5 mg/l, from 5.6×10^5 to 9.8×10^4 CFU/ml for 30 mg/l, from 8.9×10^4 to 1.9×10^3 CFU/ml for 100 mg/l, following 7 days of incubation. Similar results were found for strain O18. This is perhaps a reflection of increased levels of toxicity to the strains at higher PAE concentrations.

Table 3 presents data on the degradation constants of the eight PAEs when present simultaneously and individually. The results show that when the eight PAEs were simultaneously present, PAE degradation rates were enhanced. This is possibly because the presence of all eight compounds provides more carbon source and energy source for use by the microorganisms. These results are similar to those reported by Chang et al. (2002) for PAH degradation in soils. As shown in Table 4, we found that the DK4 strain had higher degradation rates than the O18 strain. The two strains both degraded lower molecular weight phthalates DEP, DPrP, DBP, DPP and BBP easily, and found the high molecular weight DEHP more difficult to degrade. O'Grady et al. (1985) confirmed that a correlation exists between increasing length of the ester side-chain and decreasing biodegradability.

Table 2
Remaining percentages of PAE for strain DK4 and O18 biodegradation with various initial PAE concentrations over a 7-day incubation

PAEs	Remaining percentage[a]		
	5 mg/l	30 mg/l	100 mg/l
Strain DK4			
DEP	ND[b]	21.8 ± 2.4	56.2 ± 2.3
DPrP	ND[b]	23.6 ± 2.8	68.5 ± 2.3
DBP	ND[b]	21.6 ± 2.4	65.7 ± 2.2
DHP	ND[b]	43.5 ± 3.2	83.5 ± 3.5
BBP	ND[b]	29.2 ± 1.2	69.1 ± 3.5
DEHP	10.8 ± 1.4	63.1 ± 3.2	88.5 ± 3.2
DCP	ND[b]	38.8 ± 3.2	76.0 ± 2.3
DPP	ND[b]	21.1 ± 1.1	71.4 ± 2.9
Strain O18			
DEP	ND[c]	ND[d]	ND[e]
DPrP	ND[c]	ND[d]	12.3 ± 0.3
DBP	ND[c]	ND[d]	25.3 ± 1.4
DHP	ND[c]	21.4 ± 1.2	52.7 ± 2.4
BBP	ND[c]	ND[d]	40.1 ± 5.3
DEHP	43.1 ± 3.2	72.2 ± 2.4	88.8 ± 1.3
DCP	31.1 ± 2.1	51.1 ± 2.8	68.0 ± 3.2
DPP	ND[c]	11.1 ± 1.2	48.8 ± 2.6

ND: Not detected.
[a] Values are means ± standard deviations.
[b] DEP, DPrP, DBP, DHP, BBP, DCP and DPP were completely degraded within 2, 2, 2, 4, 2, 4 and 2 days.
[c] DEP, DPrP, DBP, DHP, BBP and DPP were completely degraded within 2, 2, 4, 7, 3 and 4 days.
[d] DEP, DPrP, DBP and DPP were completely degraded within 2, 2, 3 and 4 days.
[e] DEP were completely degraded within 5 days.

Table 3
PAE mixed or individual biodegradation rate constants (k, 1/day) and half-lives ($t_{1/2}$, day) for strain DK4

PAEs	Mixed			Individual		
	k	$t_{1/2}$	r^2	k	$t_{1/2}$	r^2
DEP	5.78	0.12	0.98	0.92	0.75	0.94
DPrP	5.78	0.12	0.98	0.60	1.16	0.95
DBP	5.78	0.12	0.98	0.36	1.93	0.96
DHP	0.70	0.99	0.95	0.17	4.08	0.97
BBP	5.78	0.12	0.97	0.67	1.03	0.96
DEHP	0.23	3.01	0.98	0.07	9.90	0.98
DCP	0.69	1.00	0.99	0.11	6.30	0.95
DPP	4.33	0.16	0.96	0.23	3.01	0.96

Each data point on the various treatments were significant difference ($P < 0.05$).
Each data represents the mean of three measurements, and the standard deviation is less than 10%.

Table 4
PAE biodegradation rate constants (k, 1/day) and half-lives ($t_{1/2}$, day) for strain DK4 or strain O18 present simultaneously or individually

PAEs	Strain O18			Two strain mixed			Strain DK4		
	k	$t_{1/2}$	r^2	k	$t_{1/2}$	r^2	k	$t_{1/2}$	r^2
DEP	5.08	0.14	0.97	6.93	0.10	0.95	5.78	0.12	0.98
DPrP	4.33	0.16	0.96	5.78	0.12	0.97	5.78	0.12	0.98
DBP	3.01	0.23	0.95	3.85	0.18	0.98	5.78	0.12	0.98
DHP	0.47	1.47	0.98	1.16	0.60	0.97	0.70	0.99	0.95
BBP	4.62	0.15	0.96	4.95	0.14	0.96	5.78	0.12	0.98
DEHP	0.05	13.9	0.94	0.30	2.31	0.97	0.23	3.01	0.98
DCP	0.09	7.7	0.98	0.85	0.82	0.96	0.69	1.00	0.99
DPP	2.89	0.24	0.99	3.47	0.20	0.98	4.33	0.16	0.96

Each data point on the various treatments were significant difference ($P < 0.05$).
Each data represents the mean of three measurements, and the

Staples et al. (1997) compared PAE aerobic degradation rates for various microorganisms and these were lower than what was observed in the present study. Our observed aerobic degradation half-lives for the eight PAEs were also much lower than those reported by Howard et al. (1991), 1–56 days under aerobic conditions. In the simultaneous presence of strains DK4 and O18, PAE degradation rates were also enhanced. This may be synergistic relationships allow microorganisms to produce enzymes that are not produced by either population alone (Atlas and Bartha, 1998).

The degradation of PAE in sediment by strain DK4 was also studied. As shown in Table 5, DEP, DPrP, and DBP were all completely degraded; DHP, BBP, DEHP, DCP and DPP remained at 9.3%, 0.8%, 32.6%, 10.7% and 2.8% within 7-day incubations in sediment. In comparison (Table 2), sediment-free culture samples were found to exhibit significantly lower remaining percentage of PAE degradation. This is strong evidence in support of the argument that such action is enhanced by sediment-free culture samples. One possible explanation for this significant difference is that the tendency of PAE to adsorb to sediment particles may reduce the degrading effectiveness of microorganisms by reducing the bioavailability of PAE, thus retarding the degradation process. These results are similar to those previously

Table 5
PAE degradation after addition of nonylphenol and PAHs in river sediment within a 7-day incubation

PAEs	Remaining percentage[a]		
	Inoculated control	Nonylphenol	PAHs
DEP	ND	ND	ND
DPrP	ND	ND	ND
DBP	ND	ND	ND
DHP	9.3 ± 2.1	23.2 ± 1.4	35.5 ± 2.3
BBP	0.8 ± 0.1	2.5 ± 1.1	3.5 ± 2.4
DEHP	32.6 ± 2.3	47.6 ± 4.2	64.7 ± 4.2
DCP	10.7 ± 0.9	30.8 ± 2.2	45.8 ± 1.1
DPP	2.8 ± 1.1	5.1 ± 0.9	6.8 ± 0.9

ND: Not detected.
Each data point on the various treatments were significant difference ($P < 0.05$).
[a] Values are means ± standard deviations.

reported by this group for phenanthrene degradation in the river sediment (Yuan et al., 2001).

Several organic pollutants such as PAHs, PAE and nonylphenol are present in the river sediment collected in this study (Liu et al., 2000). For this reason the effect of addition of PAHs and nonylphenol on PAE degradation by the DK4 strain in the river sediment was also studied. Table 5 presents data on the effects of nonylphenol and PAHs on PAE degradation. PAE degradation was delayed by the addition of nonylphenol or PAHs at a concentration of 1 μg/g. We also found the remaining percentages of nonylphenol and PAHs were 45.3% and 57.4% within 7-day incubation. Nonylphenol or PAHs may be used as carbon sources energy source prior to the PAE by strain DK4 and thus delay PAE degradation.

In conclusion, two aerobic strains DK4 and O18, were isolated from PAE contaminated sediments or sludge; the two strains were capable of degrading PAE. The strains, DK4 and O18 were identified as *Corynebacterium* sp. and *Sphigomonas* sp., respectively. The two strains were found to rapidly degrade PAE with shorter alkyl-chains, i.e. DEP, DPrP, DBP, BBP and DPP are very easily biodegraded, while PAE with longer alkyl-chains, i.e. DCP and DHP and DEHP were are poorly degraded. The results of this study also show that eight PAEs biodegradation is affected by changes in pH value, temperature, PAE concentration and by the addition of nonylphenol and PAHs. Based on these findings, future work will attempt to define more precise parameters, which can be used for evaluation of the possible bio-treatment of PAE contaminated sludge or sediment.

Acknowledgement

This research was supported by the National Science Council, Republic of China (NSC90-2745-P-031-004).

References

Atlas, R.M., Bartha, R., 1998. Microbiology ecology: fundamental and applications. An imprint of Addison Wesley Longman, Inc., Menlo Park, California.

Chang, B.V., Shiung, L.S., Yuan, S.Y., 2002. Anaerobic degradation of polycyclic aromatic hydrocarbons in soil. Chemosphere 48, 717–724.

Ejlertsson, J., Johasson, E., Karlsson, A., Meyerson, U., Svensson, B.H., 1996. Anaerobic degradation of xenobiotics by organisms from municipal solid waste under landfilling conditions. Anton. Leewen. 69, 69–74.

Giam, C.S., Atlas, E., Powers Jr., M.A., Leonard, J.E., 1984. Phthalic acid esters. In: Hutzinger, O. (Ed.), Handbook of Environmental Chemistry, Part C, vol. 3. Springer-Verlag, New York, Berlin, pp. 67–140.

Howard, P.H., Boethling, R.S., Jarvis, W.F., Meylan, W.M., Michalenko, E.M., 1991. Handbook of Environmental Biodegradation Rates. Lewis Publishers Inc., Michigan.

Huff, J.E., Kluwe, W.M., 1984. Phthalate esters carcinogenicity in F344/N rates and B6C3 F mice. Prog. Clin. Biol. Res. 141, 137–154.

Inman, I.C., Strachan, S.D., Sommers, L.E., Nelson, D.W., 1984. The decomposition of phthalate esters in soil. J. Environ. Sci. Heal. Ser. B 19, 245–257.

Jianlong, W., Ping, L., Yi, Q., 1995. Microbial degradation of di-*n*-butyl phthalate. Chemosphere 31, 4051–4056.

Jianlong, W., Ping, L., Yi, Q., 1996. Biodegradation of phthalic acid esters by acclimated activated sludge. Environ. Int. 22, 737–741.

Liu, C., Wang, S.K., Lu, Y.B., 2000. Chemical characterization of Danshui River sediment in northern Taiwan. Toxicol. Environ. Chem. 76, 205–218.

O'Grady, D.P., Howard, P.H., Warner, A.F., 1985. Activated-sludge biodegradation of 12 commercial phthalate-esters. Appl. Environ. Microbiol. 49, 443–445.

Shanker, R., Ramakrishnac, C., Seth, P.K., 1985. Degradation of some phthalic acid esters in soil. Environ. Pollut. Ser. B. 39, 1–7.

Shelton, D.R., Boy, S.A., Tiedje, J.M., 1984. Anaerobic degradation of phthalic acid esters in sludge. Environ. Sci. Technol. 18, 93–97.

Staples, C.A., Peterson, D.R., Parkerton, T.F., Adams, W.J., 1997. The environmental fate of phthalate esters: a literature review. Chemosphere 35, 667–749.

Yuan, S.Y., Chang, J.S., Chang, B.V., 2001. Biodegradation of phenanthrene in river sediment. Chemosphere 43, 273–278.

Yuan, S.Y., Liao, C.S., Liu, C., Chang, B.V., 2002. The occurrence and microbial degradation of phthalate esters of aquatic environment in Taiwan. Chemosphere 49, 1295–1299.

Zhang, G., Peardon, K.F., 1990. Parametric study of diethyl phthalate biodegradation. Biotechnol. Lett. 21, 699–704.

Appl Microbiol Biotechnol (2005) 66: 702–710
DOI 10.1007/s00253-004-1683-6

APPLIED MICROBIAL AND CELL PHYSIOLOGY

C. S. Quan · Q. Liu · W. J. Tian · J. Kikuchi · S. D. Fan

Biodegradation of an endocrine-disrupting chemical, di-2-ethylhexyl phthalate, by *Bacillus subtilis* No. 66

Received: 14 January 2004 / Revised: 21 May 2004 / Accepted: 31 May 2004 / Published online: 23 October 2004

Abstract A bacterial strain capable of rapidly degrading di-2-ethylhexyl phthalate (DEHP) was isolated from soil and identified as *Bacillus subtilis*. The organism also utilized di-butyl phthalate, di-ethyl phthalate, di-pentyl phthalate, di-propyl phthalate, and phthalic acid as sole carbon sources; and their biodegradation ratio was over 99%, when the incubation was performed for 5 days at 30°C. The microorganism degraded di-2-ethylhexyl phthalate and di-butyl phthalate through the intermediate formation of mono-2-ethylhexyl phthalate and mono-butyl phthalate, which were then metabolized to phthalic acid and further by a protocatechuate pathway, as evidenced by oxygen uptake studies and GC-MS analysis. The decontamination of soil polluted with di-2-ethylhexyl phthalate by *B. subtilis* was investigated. Experimental results showed that the strain could degrade about 80% of 5 mM DEHP simply by adding 8% culture medium to soil, indicating that the degradation can occur even when other organisms are present.

Introduction

Phthalates are diesters of phthalic acid with an alcohol moiety. The carbon chain length of the alcohol for commercially relevant and available phthalates on the market can vary from one carbon atom up to 18 carbon atoms. Di-2-ethylhexyl phthalate, also commonly called bis(2-ethylhexyl)phthalate (DEHP), is a colorless, oily liquid with a slight odor. It is primarily used as one of the several plasticizers in polyvinyl chloride (PVC) resins for fabricating flexible vinyl products (Graham 1973; Peakall 1975). These PVC resins are used to manufacture teething rings, soft squeezy toys, shower curtains, adhesives, components of paper and paperboard, deformable agents, enclosures for food containers, animal glue, surface lubricants, flexible devices for administering parenteral solutions, and other products that must stay flexible and uninjurious throughout their lifetime.

Due to the widespread use of phthalates, there is deep concern about their release into the environment and their toxicity to human beings and other organisms, since some of them are considered as potential carcinogens, teratogens, and mutagens (Autian 1973; Ganning et al. 1984; Giam et al. 1978; Jobling et al. 1995; Kaul et al. 1982; Keith and Telliard 1979; Mayer and Sanders 1973; Mayer et al. 1972; Thomas et al. 1986; Wangs 1987; Woodward 1990). Specifically, it is reported that DEHP, one of the most recalcitrant phthalate esters, has xeno-estrogenic, carcinogenic, and mutagenic effects (Beliles et al. 1989; Nielsen and Larsen 1996; Schulz 1989). DEHP is listed as a priority pollutant by the United States Environmental Protection Agency and by China National Environmental Monitoring. Repeated exposure to DEHP may affect the kidneys and liver and may cause numbness and tingling in the arms and legs. Exposure can occur through inhalation, ingestion, or dermal contact; and it may cause irritation to the eyes, nose, and throat.

Metabolic breakdown of phthalate esters by microorganisms is considered to be one of the major ways of environmental degradation of these widespread pollutants. A number of studies have reported on the biodegradation of phthalates in natural water, wastewater, and soil (Christopher et al. 2002; Colin et al. 2000; Hariklia et al. 2003; Norbert 2003; Subhankar and Tapan 2003; Wang et al. 1997, 2000). Many bacteria have been isolated from rivers, soil, and even marine regions for their ability to degrade phthalate aerobically or anaerobically (Aftring and Taylor 1981; Engelhardt et al. 1976; Keyser et al.

C. S. Quan · Q. Liu · W. J. Tian · S. D. Fan
Department of Bio-Engineering, Dalian Nationalities University,
Economical and Technological Development Zone,
Dalian, 116600, China

J. Kikuchi · S. D. Fan (✉)
Graduate School of Materials Science, Nara Institute of Science and Technology,
8916-5 Takayama Ikoma,
Nara, 630-0192, Japan
e-mail: sdfan@ms.aist-nara.ac.jp
Tel.: +81-743-726091
Fax: +81-743-726091

1976; Nakazawa and Hayashi 1977; Nomura et al. 1989; Nozawa and Maruyama 1988; Ribbons et al. 1984; Taylor 1985; Taylor et al. 1981). To date, it is well known that phthalic acid esters (PAEs) with shorter alkyl chains [i.e., di-ethyl phthalate (DEP), di-butyl phthalate (DBP)] are very easily biodegraded, while PAEs with longer alkyl chains [i.e., di-octyl phthalate (DOP), DEHP] are poorly degraded under aerobic and anaerobic conditions; and it also confirmed that a correlation exists between increasing length of the ester side-chain and decreasing biodegradability (O'Grady et al. 1985). In the bacterial degradation of PAEs, two catabolic pathways have been identified for their biodegradation. Some organisms can selectively hydrolyze only one ester bond, to give mono-alkylphthalate and alcohol, where the latter compound is then used for growth, while other organisms are capable of complete mineralization of either the mono-alkyl- or di-alkylphthalates. A few studies have reported in recent years on the biodegradability of DEHP by fungal enzymes and activated sludge (Johnson and Lulves 1975; Kim et al. 2003; O'Connor et al. 1989; Parker et al. 1994).

In this report, we describe the isolation and characterization of *Bacillus subtilis* No. 66 that degrades DEHP and DBP through a protocatechuic acid (PCA) pathway.

Materials and methods

Isolation of DEHP-utilizing bacteria

Soil samples were obtained from a golf factory, drainage canal, gas station, furnace, sake factory, hospital, and plastic factory. Approximately 10 g (fresh weight) of each soil sample was suspended in 90 ml of saline, with shaking. After the soil was precipitated, 100 μl of each sample was added to 7 ml of DEHP complex medium containing (per liter): 3 g NH_4Cl, 0.2 g $MgSO_4 \cdot 7H_2O$, 0.1 g $FeSO_4 \cdot 7H_2O$, 0.1 g $CaCl_2 \cdot H_2O$, 1.2 g NaH_2PO_4, 11.9 g Na_2HPO_4, 0.1 g corn steep liquor and 10 mM DEHP. The pH was adjusted to 7.5. The tubes were incubated on a reciprocal shaker (330 rpm; Takasaki, Saitama, Japan) at 30°C until a white turbidity appeared. The isolation and enrichment of bacteria capable of degrading DEHP was performed using a sequential subculture technique in DEHP complex medium.

DNA base composition and 16S rDNA sequence analysis

Determination of the G+C content of DNA was performed using HPLC. Exponential-phase cells (18 h) grown in DEHP complex medium at 30°C on a rotary shaker were harvested and total DNA was extracted and purified, using the method of Marmur (1961). The purified DNA was dissolved in distilled water (1 mg/ml) and then heated at 100°C for 15 min before being cooled rapidly in an ice bath. To the denatured DNA (10 μg) was added 10 μl of nuclease P1 solution (2 units/ml, 40 mM sodium acetate buffer containing 2×10^{-4} M $ZnCl_2$, pH 5.3; Yamasasyoyu, Choshi, Japan) before incubation at 50°C for 1 h. A standard solution (Yamasasyoyu) and the hydrolysate were subjected separately to a HPLC column (6×150 mm; Cosmosil, USA) and eluted at room temperature, with 0.05% $NH_4H_2PO_4$ solution at a flow rate of 1.0 ml/min.

PCR amplification of the 16S rRNA gene was performed as described by Embley (1991), using a GeneAmp 2700 PCR system (Applied Biosystems, Foster City, Calif., USA). The PCR amplification primers used were 16S-8f (5'-AGAGTTTGATCCTGGCTCAG-3') and 16S-1525 (5'-AAAGGAGGTGATCCAGCC-3'), which represented a 16S rRNA gene of *Escherichia coli*. Chromosomal DNAs used as template were prepared from strain using an InstaGene Matrix (Bio-Rad, Hercules, Calif., USA), following the manufacturer's instructions. DNA fragments were analyzed by agarose gel electrophoresis under standard conditions. The agarose gel DNA purification kit (Takara, Dalian, China) was used to recover DNA fragments from the agarose gels. Purified PCR product was sequenced directly by an ABI Prism 377XL DNA sequencer (Applied Biosystems) with the primers listed in Table 1. The DNAsis-Mac program was used for connecting the sequence of fragments; and the BLASTN program was used for a gene homology search with standard defaults. The nuclear sequence of the 16S rDNA gene for the strain was deposited in the DDBJ database with accession number AB110598.

Physiological characterization

API 50 CHB and API 20 E kits (BioMérieux, Tokyo, Japan) were used for physiological characterization of the strain. The incubation temperature was 30°C.

Isolation and methylation of metabolites

To identify metabolites, the strain was inoculated into 100 ml of DEHP (or DBP) complex medium in a 500-ml Sakaguchi flask and incubated for 5 (or 3) days at 30°C. The culture supernatant was concentrated by an evaporator (Eyela, Tokyo, Japan) at 50°C and then the metabolites were separated on silica gel (Plate silica gel 60 F_{254}; Merck, Darmstadt, Germany) by thin layer chromatogra-

Table 1 Fluorescence-labeled primers for direct sequencing of 16S rDNA gene. *E. coli* numbering shows the position in *E. coli* 16S rRNA. *f* Forward, *r* Reverse

Primer	*E. coli* numbering	Base arrangement
r1L	536–518	5'-GTATTACCGCGGCTGCTGG-3'
r2L	821–803	5'-CATCGTTTACGGCGTGGAC-3'
r3L	1,111–1,093	5'-TTGCGCTCGTTGCGGGACT-3'
r4L	1,406–1,389	5'-ACGGGCGGTGTGTACAAG-3'
926f	907–926	5'-AAACTCAAAGGAATTGACGG-3'
f3L	1,094–1,112	5'-GTCCCGCAACGAGCGAAC-3'

phy with butanol:formic acid:water (4:1:2) as the solvent system. The chromatogram was visualized under UV light and the spots were scraped using a microspatula. Metabolites were extracted with 5 ml of diethyl ether, insoluble compounds were removed by centrifugation, and methylation was performed using the method of Kishimoto (1995).

Analytical methods

The cells and the liquid phase were separated by centrifugation at 5,000 *g*. Phthalate in the supernatant was extracted by adding 30% hexane. One milliliter of the hexane phase was added to a microtube (1.5 ml) and centrifuged for 15 min at 16,000 *g*. Then, 2 mg of sodium sulfate were added to 150 µl of supernatant and this was used for PAE analysis. PAE content was analyzed by gas chromatography (GC model 14 B; Shimazu, Kyoto, Japan) using a glass column (2 m long, 3 mm diam.) packed with OV-1 silicon (GL Science Co., Tokyo, Japan). The temperature of the column, injection port, and flame ionization detector were 200, 220, and 220°C, respectively. Nitrogen was used as a carrier gas at a flow rate of 60 ml/min.

Analysis of the biodegraded products of PAEs was performed by GC-MS, using a Jeol SX102A instrument (Nihondenshi, Tokyo, Japan) fitted with a fused capillary column (DV-1, 15 m long, 0.25 mm diam.). The initial temperature was 100°C and increased to 300°C at 10°C/min. The injection volume was 0.5 µl. The mass spectrometer was operated at an electron ionization energy of 70 eV.

Degradation of DEHP in soil by strain No. 66

To determine the biodegradability of DEHP in soil, 2.4 ml of DEHP complex liquid medium and 27.4 g of soil were autoclaved separately and then mixed well in a clean container. The initial concentration of DEHP in the soil was 5 mM. The mixture was incubated on a rotary shaker

Table 2 Physiological characteristics of strain No. 66. + Positive, − Negative

Substrate	Utilization	Substrate	Utilization
Carbohydrates			
Glycerol	+	Erythritol	−
D-Arabinose	−	L-Arabinose	+
Ribose	+	D-Xylose	+
L-Xylose	−	Adonitol	−
β -Methyl-D-xyloside	−	Galactose	−
Glucose	+	Fructose	+
Mannose	+	Sorbose	−
Rhamnose	−	Dulcitol	−
Inositol	+	Mannitol	+
Sorbitol	+	α-Methyl-D-mannoside	−
α -Methyl-D-glucoside	+	*N*-Acetyl-glucosamine	+
Amygdalin	+	Arbutin	+
Esculin	+	Salicin	+
Cellobiose	+	Maltose	+
Lactose	−	Melibiose	+
Sucrose	+	Trehalose	+
Inulin	+	Melezitose	−
Raffinose	+	Starch	+
Glycogen	+	Xylitol	−
Gentiobiose	+	D-Turanose	+
D-Lyxose	−	D-Tagatose	−
D-Fucose	−	L-Fucose	−
D-Arabitol	−	L-Arabitol	−
Gluconate	−	2-Keto-D-gluconate	−
5-Keto-D-gluconate	−	Citrate	+
Conventional test			
o-Nitrorhenyl-β -D-galactopyranosidase	+	Arginine dihydrolase	−
Lysine decarboxylase	−	Ornithine decarboxylase	−
Tryptophane deaminase	−	H_2S production	−
Urease	−	Indole production	−
Nitrate to nitrite	+	Voges-Proskauer test	+
Gelatinase	+		

(230 rpm; Takasaki) at 30°C for 5 days and the residual concentration of DEHP was measured by the above method. To the blank (control) were added 2.4 ml of sterilized water.

Results

Isolation of strain No. 66 and its classification

Three DEHP-utilizing bacterial strains were isolated. Among them, strain No. 66 exhibited the highest degradation ability, so this strain was used for further studies. The complete 16S rDNA sequence of strain No. 66 was determined. The sequence was compared with published 16S rDNA sequences of representative members of the genus *Bacillus*. Although the sequence showed a high degree of similarity to the sequence of *B. subtilis* (100%), it was also related to *B. vallismortis* (99.67% similarity), *B. amyloliquefaciens* (99.08% similarity), and *B. atrophaeus* (99.27% similarity). To make certain species of this strain, morphological and physiological tests were also performed. Colonies of strain No. 66 on a nutrient agar plate were circular, smooth, and yellowish. The cell was an aerobic, gram-positive, spore-forming rod and the G+C content was found to be 40.5±0.3 mol%. The results of API 50 CHB and API 20 E tests are listed in Table 2. From the above results, strain No. 66 was identified as *B. subtilis* and designated as *B. subtilis* No. 66.

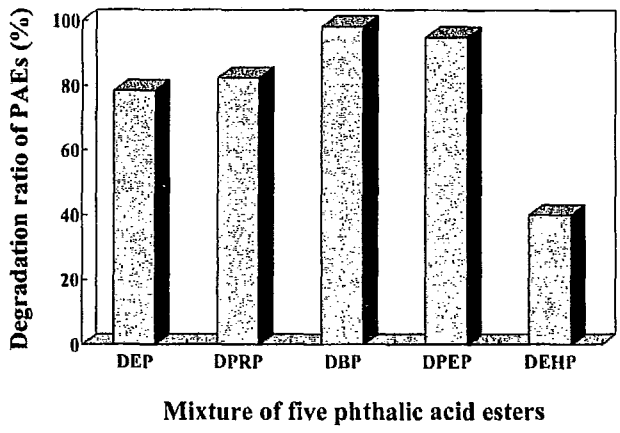


Fig. 1 Degradation ratio of a mixture of five phthalic acid esters by strain No. 66. The initial concentration of each phthalic acid ester was 2 mM. The degradation was carried out for 5 days at 30°C

Table 3 Oxidation of potential intermediates of PAE metabolism by washed cells of strain No. 66. The oxygen uptake of intact cells was determined using a model 5300 biological oxygen monitor (YSI, Yellow Springs, Ohio, USA) according to the method of Richard and Douglas (1982). The pre-incubation period for growth was 3 days at 30°C. The reaction temperature was 30°C. *N.D.* Not detected

Growth substrate	Reaction substrate	Oxygen uptake of 1 mg of No. 66 (dry cell weight; nmol/min)
Phthalic acid	Fumaric acid	196.6
	PCA	47.5
	Phthalic acid	92.4
	DBP	26.3
	DEHP	9.5
DEHP	Fumaric acid	5.9
	PCA	7.3
	Phthalic acid	8.1
	DBP	15.5
	DEHP	11.9
Fumaric acid	Fumaric acid	34.0
	PCA	N.D.
	Phthalic acid	5.7
	DBP	11.7
	DEHP	N.D.
DBP	Fumaric acid	24.5
	PCA	12.8
	Phthalic acid	12.0
	DBP	8.8
	DEHP	14.3
PCA	Fumaric acid	4.9
	PCA	34.0
	Phthalic acid	N.D.
	DBP	N.D.
	DEHP	N.D.
Nutrient broth	Fumaric acid	N.D.
	PCA	N.D.
	Phthalic acid	N.D.
	DBP	N.D.
	DEHP	N.D.

Biodegradation of DEHP and other PAEs in liquid culture

B. subtilis No. 66 was able to utilize DEP, di-propyl phthalate (DPRP), DBP, di-pentyl phthalate (DPEP), and DEHP as sole sources of carbon and energy. The hydrolysis ratio of each of the above PAEs (10 mM) by this strain was 100, 99.5, 100, 100, and 81.6%, respectively, when the biodegradation was performed for 5 days at 30°C.

The hydrolysis ratio of various PAEs was determined when DEHP was replaced with a PAE mixture where the concentration of each PAE was 2 mM. As shown in Fig. 1, DEP, DPRP, DBP, and DPEP, which have a short alkyl side-chain, exhibited a high hydrolysis ratio (over 80%), but DEHP showed a hydrolysis ratio of only 40%.

Oxidation of metabolic intermediates by whole cells

The general opinion of the biodegradation pathway of phthalates is that hydrolysis of the ester side-chain of the di-alkylphthalate through mono-alkylphthalate occurs, leaving phthalic acid and alkyl alcohols available for further conversion. To clearly understand the degradation pathway of DEHP and DBP by this strain, the oxygen uptake of intact cells of *B. subtilis* No. 66 from the mid-logarithmic phase toward the above-mentioned intermedi-

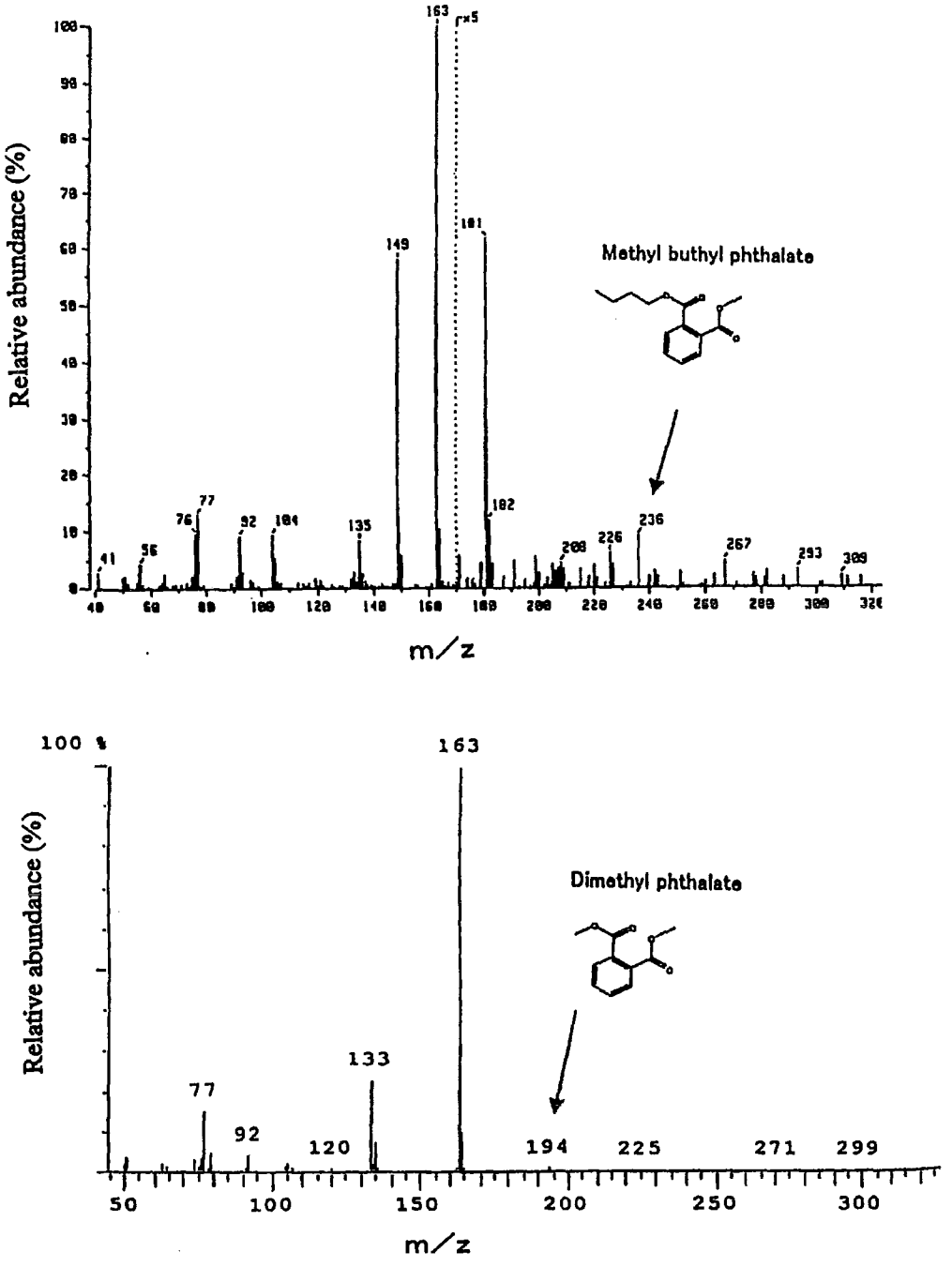


Fig. 2 Mass spectra of the methylated intermediates of DBP

ates was detected; and the results are shown in Table 3. Phthalic acid-grown cells oxidized DBP, DEHP, fumaric acid, PCA, and phthalic acid; and the oxygen uptake was 2- to 10-fold higher with phthalic acid as the reaction substrate than with other reaction substrates. The oxygen uptake was higher when DBP or DEHP was used as reaction substrate than when PCA was used. Moreover, it is found that the oxygen uptake of DBP-grown cells was same as that of DEHP-grown cells when fumaric acid, PCA, phthalic acid, DBP, or DEHP was used as reaction substrate. PCA-grown cells did not oxidize phthalic acid, DBP, or DEHP. Therefore, the microorganism degrades DEHP through phthalic acid and PCA; and the enzyme used for the degradation of phthalic acid is inducible.

Identification of metabolites

A spot was detected with a R_f value of 0.31, which is the same as that of phthalic acid, when the strain was cultivated on DBP complex medium for 3 days. In contrast, a broad band was determined from the culture

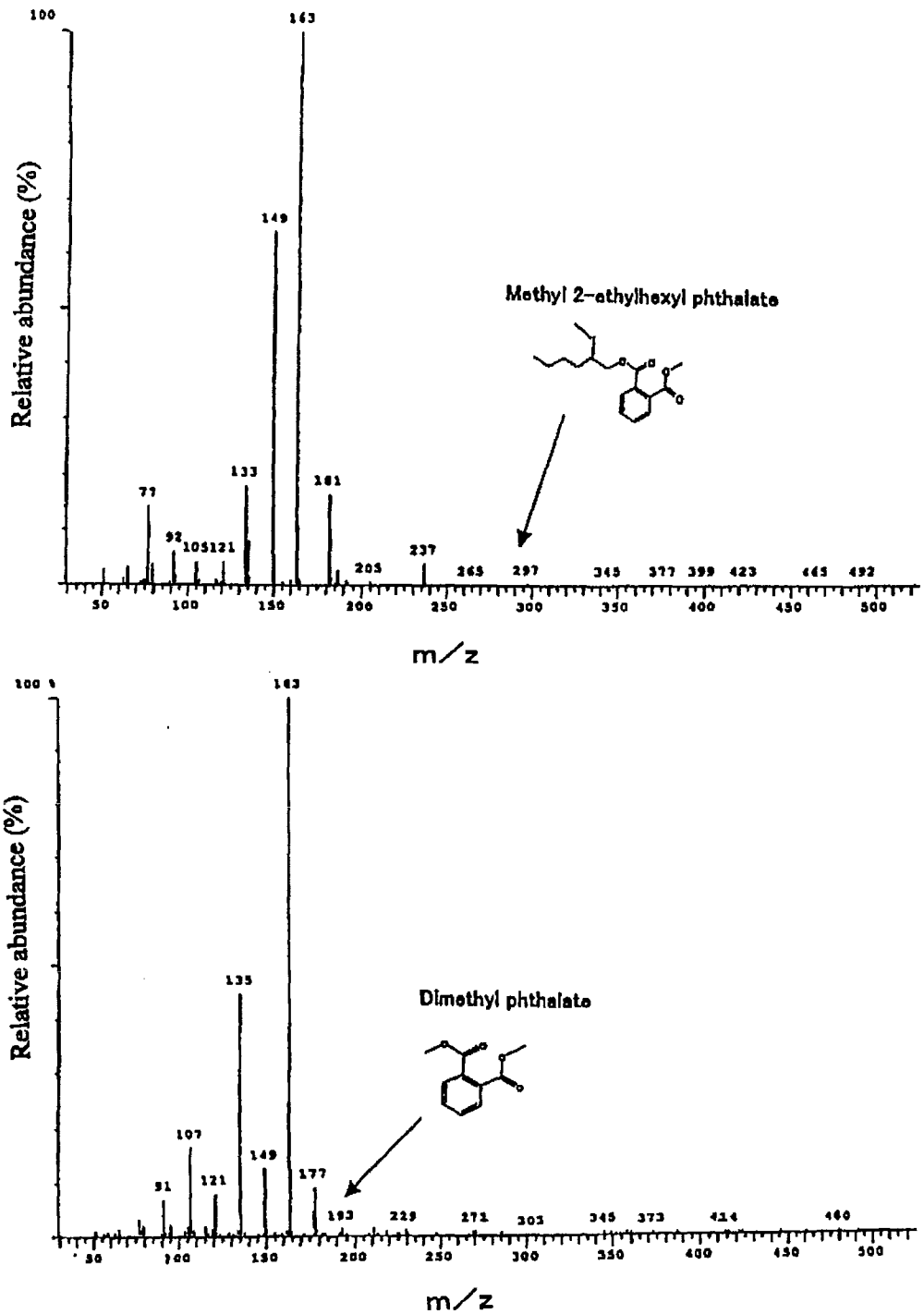


Fig. 3 Mass spectra of the methylated intermediates of DEHP

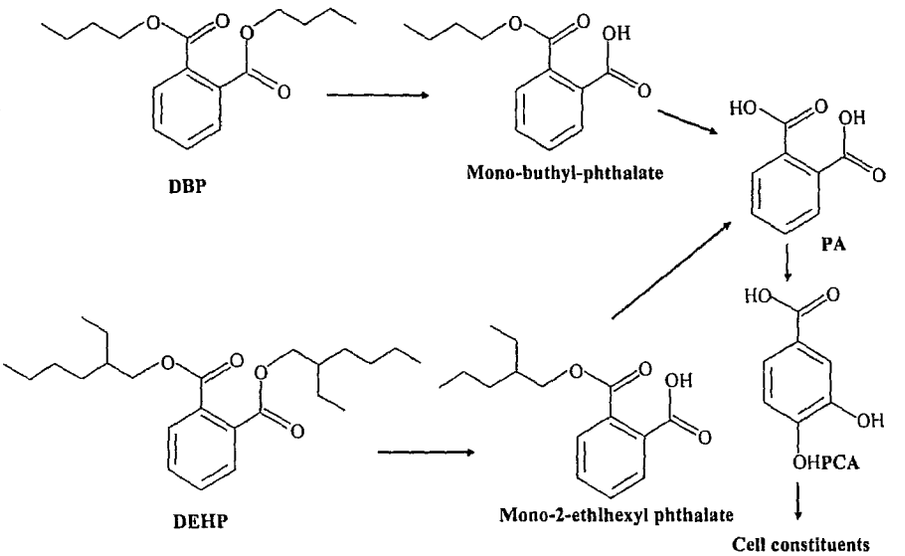


Fig. 4 Proposed pathways for DEHP and DBP degradation by strain No. 66

supernatant when DEHP was used as sole source of carbon. To identify the metabolites, the chromatogram was scraped off, extracted with diethyl ether, and analyzed by GC and GC-MS. The GC analysis results showed that methylated intermediates from the degradation of DBP appeared as two peaks; and the retention time of one peak was considered to indicate methylated phthalic acid. But the two peaks completely disappeared after incubation for 5 days and no new peak appeared. The result of DEHP degradation was same as for DBP, but the peak disappeared after incubation for 7 days. In the case when DBP was used as carbon source, the isolated products were identified as methyl buthyl phthalate and dimethyl phthalate (DMP), respectively (Fig. 2). In another case when DEHP was used as sole carbon source, the isolated products were identified as methyl 2-ethylhexyl phthalate and DMP, respectively (Fig. 3). According to the oxygen uptake studies and GC-MS analysis, the pathway for DEHP degradation by *B. subtilis* No. 66 was suggested (Fig. 4). However, the strain did not cause an accumulation of PCA in the culture medium. It might mean that the enzymes related to the degradation of PCA by this organism had a high affinity for PCA.

Decontamination of soil polluted by DEHP

The biodegradation ratio of DEHP was over 80%, either autoclaved or unautoclaved, when 2.4 ml of DEHP complex medium was added to soil. In contrast, there was low or no degradation in soil mixed with water (Table 4). It is pointed out that biodegradation can occur even when other organisms are present and the amount of strain No. 66 is important.

Discussion

Since endocrine-disrupting chemicals may affect the reproduction and growth of living beings, this issue has attracted a lot of attention in recent years and is becoming a new environmental program. Currently, 38,000 chemicals and several heavy metals are reported as chemical substances suspected to have an endocrine-disrupting action. Two properties are mentioned as a feature of these endocrine-disrupting chemicals. The first is that many endocrine-disrupting chemicals are soluble in adipose, i.e., these chemicals gradually accumulate in an organism's body through biological concentration. The second is that a very strong endocrine-disrupting action occurs when more than one such compound exists simultaneously, although the individual endocrine-disrupting action is weak. So it is very necessary to use microbes to decontaminate phthalates, which are the endocrine-disrupting pollutants with the highest concentration.

The most commonly studied PAEs (which are also the ones most commonly found in the environment) are DEP, DBP, DMP, DEHP, and DOP (Hariklia et al. 2003). Many

Table 4 Biodegradation of DEHP by strain No. 66 in soil (autoclaved or not autoclaved). The content of water/medium in these systems was equivalent to 75% of field capacity. The initial concentration of DEHP was 5 mM. Systems A and C were autoclaved, systems B and D were not autoclaved. The incubation period was 5 days at 30°C. *D.R.* DEHP degradation rate

System	Soil (g)	Autoclave	Medium (ml)	Water (ml)	Seed culture (ml)	D.R. (%)
A	27.6	+	2.4	0	0.5	81.3
B	27.6	−	2.4	0	0.5	84.6
C	27.6	+	0	2.4	0.5	9.9
D	27.6	−	0	2.4	0.5	0

studies exist on the biodegradation rate of these PAEs by sludge under anaerobic conditions for actual wastewater-treatment processes (Hariklia et al. 2003; Johnson and Lulves 1975; Wang et al. 2000). However, there is little information regarding biodegradation of the above PAEs, especially DEHP, by pure microbe strains and these applications (Kurane 1986; Kurane 1997). A strain exhibiting a high degradation ratio was isolated from soil and was identified as *B. subtilis*. This is the first report of a *B. subtilis* strain capable of rapidly degrading DEHP. It was found that two of the examined phthalates, DEP (10 mM) and DPEP (10 mM), were degraded with a 100% ratio and were removed very quickly (in less than 3 days at 30°C). However, the degradation ratio of DEHP was less than 90% and was relatively slower (5 days). This clearly indicated that this strain can decompose PAEs more efficiently, compared with that reported by Wang (1995; 1.43 mM DBP over 2 days). Moreover, as a result of cultivating phthalate as the sole source of carbon, it indicated that phthalate (which has a short, branched side-chain) is more easily decomposed, compared with DEHP. Even when DPEP and DEHP are simultaneously put into one culture medium, DPEP is decomposed first.

Oxygen uptake studies showed that, for both DBP and DEHP, the degradation pathway was through phthalic acid, then PCA. In the first step, only one ester bond of DBP and DEHP was hydrolyzed by the strain, to form mono-alkylphthalate and alcohol; and then the mono-alkylphthalate was hydrolyzed to PCA and alcohol. PCA-grown cells did not oxidize phthalic acid, DBP, or DEHP. These results suggested that some inducible enzyme acted on the reaction from PAE to phthalic acid. The pathway of phthalic acid degradation by this strain will be made clear by further studies.

Saeger (1976) reported that, on adding DEHP (1 mg/l) into river water without treatment, only 40% of DEHP was decomposed after 6 weeks, whereas phthalic acid (12.5 mg/l) was completely decomposed by microbes existing in the environment after 17 days, in the same condition as DEHP. The above results indicated that there are some species of microbe decomposing phthalic acid in the natural environment and that it is difficult to decompose DEHP in the natural state. Therefore, finding a new strain with a high degradability of DEHP into phthalic acid will be the key point for the decontamination of phthalate in the environment. The decontamination experiment of phthalate pollution in soil demonstrated that strain No. 66 can decompose about 80% of 5 mM DEHP simply by adding 8% culture medium to soil at 30°C for 5 days. The soil moisture at this time was comparable to the moisture of wet soil. To decontaminate polluted soil, continuous agitation and the addition of culture medium were necessary (data not shown).

In order to remove PAEs from the environment more efficiently, it is necessary to create a bioreactor. Kurane (1997) reported that phthalate esters were efficiently removed from wastewater by inoculating viable cells of *Rhodococcus erythropolis* and *Pseudomonas* sp. into activated sludge as a biological treatment system and also reported on a rapid PCR method and fluorescent antibody techniques for tracing the activated microorganisms. The biological treatment of a DMP-containing waste stream was successfully performed with a high degradation rate in a packed-bed reactor by Juneson et al. (2002), using an acclimated mixed bacterial culture. Besides the methods mentioned immediately above, the following two methods may be considered. At a low-concentration contamination, commingling PAEs with water, the strain can be fixed to a biofilter and the DEHP removed by passage through the filter. Under a high-concentration contamination (since DEHP density is lower than that of water), DEHP floats. Fixing this strain to floating beads to attempt decontamination may be considered.

References

Aftring RP, Taylor BF (1981) Aerobic and anaerobic catabolism of phthalic acid by a nitrate respiring bacteria. Arch Microbiol 130:101–104

Autian J (1973) Toxicity and health threats of phthalate esters: a review of the literature. Environ Health Perspect 4:3–26

Beliles R, Salina JA, Klune WM (1989) A review of di-(2-ethylhexyl) phthalate (DEHP) risk assessments. Drug Metab Rev 21:3–12

Christopher J, Owen PW, Ajay A (2002) Biodegradation of dimethyl phthalate with high removal rates in a packed-bed reactor. World J Microbiol Biotechnol 18:7–10

Colin DC, Sarah AO, Ian PT, Richard GB (2000) Biodegradation of diethyl phthalate in soil by a novel pathway. FEMS Microbiol Lett 186:27–34

Embley TM (1991) The liner PCR reaction: simple and robust method for sequencing amplified rRNA genes. Lett Appl Microbiol 13:171–174

Engelhardt G, Wallnőfer PR, Rast HG (1976) Metabolism of *o*-phthalic acid by different gram-negative and gram-positive soil bacteria. Arch Microbiol 109:109–114

Ganning AE, Brunk U, Dallner G (1984) Phthalate esters and their effect on the liver. Hepatology 4:541–547

Giam CS, Chan HS, Neff GS, Atlas EL (1978) Phthalate ester plasticizers: a new class of marine pollutant. Science 199:419–420

Graham PR (1973) Phthalate ester plasticizers—why and how they are used. Environ Health Perspect 3:3–12

Hariklia NG, Felipe AM, Reza I, Birgitte KA (2003) Biodegradation of phthalate esters during the mesophilic anaerobic digestion of sludge. Chemosphere 52:673–682

Jobling S, Reynolds T, White R, Parker MG, Sumpter JP (1995) A variety of environmentally persistent chemicals, including some phthalate plasticizers, are weakly estrogenic. Environ Health Perspect 103:582–587

Johnson G, Lulves WJ (1975) Biodegradation of di-*n*-butyl phthalate and di-ethylxyl phthalate in freshwater hydrosoil. J Fish Res Board Can 32:333–339

Juneson C, Ward OP, Singh A (2002) Biodegradation of dimethyl phthalate with high removal rates in a packed reactor. World J Microbiol Biotechnol 18:7–10

Keith LM, Telliard WA (1979) Priority pollutants. I. A perspective view. Environ Sci Technol 13:416–423

Keyser P, Pujar RW, Eaton RW, Ribbons DW (1976) Biodegradation of phthalates and their esters by bacteria. Environ Health Perspect 18:159–166

Kim YH, Lee J, Moon SH (2003) Degradation of an endocrine disrupting chemical, DEHP [di-(2-ethylhexyl)-phthalate], by *Fusarium oxysporum* f. sp. pisi cutinase. Appl Microbiol Biotechnol 63:75–80

Kishimoto S (1995) Studies on the criterion of compost. Hiroshima University, Hiroshima
Kurane R (1997) Microbial degradation and treatment of polycyclic aromatic hydrocarbons and plasticizers. Ann N Y Acad Sci 829:118–134
Marmur J (1961) A procedure of the isolation of deoxyribonucleic acid from microorganisms. J Mol Biol 3:208
Mayer FL, Sanders HO (1973) Toxicity of phthalic acid esters in aquatic organisms. Environ Health Perspect 3:153–157
Mayer FL, Stalling DL, Johnson JL (1972) Phthalate esters as environmental contaminants. Nature 238:411–413
Nakazawa T, Hayashi E (1977) Phthalate metabolism in *Pseudomonas testosteroni*: accumulation of 4,5-dihydroxyphthalate by a mutant strain. J Bacteriol 131:42–48
Nielsen E, Larsen PB (1996) Toxicological evaluation and limit values for DEHP and phthalates other than DEHP. Danish Environmental Protection Agency, Copenhagen
Nomura Y, Takada N, Oshima Y (1989) Isolation and identification of phthalate-utilization bacteria. J Ferment Bioeng 74:333–344
Norbert S (2003) Ecotoxicity and biodegradation of phthalate monoesters. Chemosphere 53:921–926
Nozawa T, Maruyama Y (1988) Denitrification by a soil bacteria with phthalate and other aromatic compounds as substrates. J Bacteriol 170:2501–2505
O'connor OA, Rivera MD, Young LY (1989) Toxicity and biodegradation of phthalic acid esters under methanogenic conditions. Environ Toxicol Chem 8:569–576
O'Grady DP, Howard PH, Warner AF (1985) Activated sludge biodegradation of 12 commercial phthalate-esters. Appl Environ Microbiol 49:443–445
Parker WJ, Monteith HD, Melcer H (1994) Estimation of anaerobic biodegradation rates for toxic organic compounds in municipal sludge digestion. Water Res 28:1779–1789
Peakall DB (1975) Phthalate esters: occurrence and biological effects. Residue Rev 54:1–41
Ribbons DW, Keyser P, Kunz DA, Taylor BF, Eaton RW, Anderson BN (1984) Microbial degradation of phthalate. In: Gibson DT (ed) Microbial degradation of organic compounds. Marcel, New York, pp 371–397
Richard WE, Douglas WR (1982) Metabolism of di-butyl phthalate by *Micrococcus*sp. strain 12 B. J Bacteriol 151:49–57
Saeger VW (1976) Biodegradation of phthalic acid esters in river water and activated sludge. Appl Environ Microbiol 31:29–34
Schulz CO (1989) Assessing human health risks from exposure to di (2-ethylxyl)-phthalate (DEHP) and related phthalates-scientific issues. Drug Metab Rev 21:111–120
Subhankar C, Tapan KD (2003) Metabolism of butyl benzyl phthalate by *Gordonia* sp. strain MTCC 4818. Biochem Biophys Res Commun 309:36–43
Taylor BF (1985) An Na^+-independent decarboxylation in a marine bacterium: ion-controlled biotransformations with intact cells. FEMS Microbiol Lett 29:279–283
Taylor BF, Curry RW, Corcoran EF (1981) Potential for biodegradation of phthalic acid esters in marine regions. Appl Environ Microbiol 42:590–595
Thomas JA, Wienckowski DB, Gillies BA, Thomas MJ (1986) Effects of phthalalic acid esters (PAEs) on the neonate and aspects of tetratogenic actions. Environ Health Perspect 65:243–248
Wang JL (1995) Microbial degradation of di-*n*-buthyl phthalate. Chemosphere 31:4051–4056
Wang J, Liu P, Qian Y (1997) Biodegradation of phthalic acid esters by immobilized microbial cells. Environ Int 6:775–782
Wang J, Chen L, Shi H, Qian Y (2000) Microbial degradation of phthalic acid esters under anaerobic digestion of sludge. Chemosphere 41:1245–1248
Wangs TJ (1987) Diethylhexyl phthalate as an environmental contaminant—a review. Sci Total Environ 66:1–16
Woodward KN (1990) Phthalate esters, cystic kidney disease in animals and possible effects on human health: a review. Hum Exp Toxicol 9:397–401

Appendix E
Quality Assurance Project Plan (QAPP)

Appendix F
Health & Safety Plan

Risk Analysis (RA)

(Required for all RMT field projects.)

1. General Information

Business Unit: ☒ Environmental Consulting, Construction, or Remediation

☐ SmartBurn™

Client Name:	PolyOne	Project #:	6527.30	Task #:
Project Name:	L.E. Carpenter Site Work	Project Manager:	Nicholas Clevett	
Street Address:	170 N. Main St.	City, State, ZIP	Wharton, NJ 07885	
Prepared By:	Scott Pawlukiewicz	Date:	July 24, 2008	
Approved By:	(PM)	Approved By:		(HSC)
	Nicholas Clevett		Jennifer Overvoode	
Date:		Date:		

Proposed Date(s) of Work: August 2008 to December 2009.

Proposed Scope of Work On Site:

Risk Analysis (RA)

(Required for all RMT field projects.)

The proposed scope of work includes the installation and surveying of additional groundwater monitoring wells, surveying, IDW management, wetland maintenance, and groundwater low-flow sampling.

Monitoring Well Installation:

1. Installation of groundwater monitoring well(s), and temporary air sparge/observation point..
2. Containerize soil cuttings in fifty-five gallon drums. Decon, and development water will be contained in the onsite tank.
3. Develop monitoring well(s) using pumping and surging methods until turbidity, pH, and conductivity are stable.
4. Decontaminate all equipment using an industrial detergent (*e.g*. alconox) and rinse between sample locations.
5. Set permanent monitoring well pads and protective covers.
6. Horizontal and vertical survey inner casing, outer casing, and adjacent ground of installed monitoring wells/and temporary air sparge/observation point.
7. Collect soils samples as needed.

Wetland Area Restoration and Maintenance:

1. Restore any damage occurring from the installation of monitoring wells.
2. Perform annual wetland monitoring activities.

Groundwater Sampling:

1. Collect water elevation measurements.
2. Collect groundwater sample(s) using low-flow sampling methods.

RMT Role(s) On Site:

☐ RMT Staff Will Not Be On Site (RA is for subcontractor information only)

☐ Resident Project Representative (*e.g.,* RPR, "Observe and Document")

☐ Construction Manager (*e.g.,* CM, Managing/General Contractor)

☒ Representative for Client (*e.g.,* "Agent for Owner")

☒ General On-site Consulting/Engineering Services

☒ Other

☒ Soil Sampling	☐ Solid Waste Sampling	☐ Liquid Waste Sampling
☒ Groundwater Sampling	☒ Surface Water Sampling	☐ Wastewater Sampling
☐ Sediment Sampling	☐ Surveying	☐ Specify

Risk Analysis (RA)

(Required for all RMT field projects.)

Major Project Tasks		RMT Task	Subcontractor Task	Minimum PPE Level Required see HSP for details (suggested levels for Subcontractor work)
1.	Installation of groundwater monitoring wells.	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
2.	Containerize soil cuttings in fifty-five gallon drums. Decon, and development water will be contained in the onsite tank.	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
3.	Develop all monitoring wells using pumping and surging methods until turbidity, pH, and conductivity are stable	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
4.	Decontaminate all equipment using an industrial detergent (e.g. alconox) and rinse between sample locations.	☒	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
5.	Set permanent monitoring well pads and protective covers.	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
6.	Horizontal and vertical survey inner casing, outer casing, and adjacent ground of installed monitoring wells.	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
7.	Restore any damage occurring from the installation of monitoring wells.	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
8.	Perform annual wetland monitoring activities.	☐	☒	☐ N/A ☒ D ☐ C ☐ B ☐ A
9.	Collect water elevation measurements.	☒	☐	☐ N/A ☒ D ☐ C ☐ B ☐ A
10.	Collect groundwater samples using low-flow sampling methods	☒	☐	☐ N/A ☒ D ☐ C ☐ B ☐ A
11.	Select soil samples.	☒	☐	☐ N/A ☒ D ☐ C ☐ B ☐ A

2. Contingency Planning

LOCAL EMERGENCY RESOURCES:	
Ambulance: 911	Emergency Room: 911
Police: 911	Fire Department: 911
USEPA Contact: ☐ N/A ☐ Specify:	Poison Control Center: 1-800-222-1222 ☐ Specify:
Other (client services offered, etc.):	

SITE RESOURCES:

Risk Analysis (RA)

(Required for all RMT field projects.)

SITE RESOURCES:			
Drinking Water Supply	☒ RMT	☐ Subcontractor	☐ Client
Wash Water Supply	☒ RMT	☒ Subcontractor	☐ Client
Telephone – Land Line		☐ Subcontractor	☒ Client
Telephone - Cellular	☒ RMT	☒ Subcontractor	
First Aid Kit	☒ RMT	☐ Subcontractor	
Fire Extinguisher	☒ RMT	☒ Subcontractor	☐ Client
Emergency Shower	☐ RMT	☐ Subcontractor	☐ Client
Eye Wash	☒ RMT	☐ Subcontractor	☐ Client
Other:	☐ RMT	☐ Subcontractor	☐ Client

EMERGENCY CONTACTS:	
RMT Technical Contact:	Jim Dexter, 616-975-5415 (office), 616-915-3658 (cell)
RMT Project Manager (PM):	Nicholas Clevett: 616-975-5415 (office), 616-780-2398 (cell)
RMT Corporate Health & Safety Manager (CHSM): - Confined Space Permits - Air Monitoring Plans - Scaffolding Permits - Demolition Plan Approval	Jason Chevallard 864/234-9369 (work) 864/525-8357 (cell)
Radiation Safety Officer (RSO):	John Hanson 608/662-5238 (work) 608/220-2502 (cell - emergency only) 608/222-4588 (home - emergency only)
RMT Health & Safety Coordinator (HSC): – Excavation Permits – Hot Work Permits – Lockout/Tagout Permits – Traffic Control Plan Approval – Lighting Plan Approval	Jennifer Overvoode 616/975-5415 (work) 616/915-3685 (home/cell)
RMT Field Contact:	Eric Vincke, 616-975-5415 (office), 616-340-0382 (cell)
Contractor Contact:	N/A
Client Contact:	N/A

Emergency Route (provide detailed directions and/or attach a map):

The emergency route should be driven at least once before fieldwork begins, to verify that the planned route is feasible. Hospitals or clinics identified for emergency medical care should also be contacted, to verify that emergency care is provided at that location. Verify the exact location of the medical facility during this call.

Hospital: DOVER GENERAL (St. Clare's) HOSPITAL

Other:

Risk Analysis (RA)

(Required for all RMT field projects.)

24 JARDINE ST, DOVER, NJ (see attached map)

Phone: (973) 989-3000

Emergency Procedures:

If an emergency develops at the site, the first responder should take the following course of action:

- Notify the proper emergency services for assistance.
- Notify other personnel at the site.
- As soon as possible, contact the RMT Incident Reporting Operator to inform them of the incident.
- Prepare a summary report of the incident for the client representative as required.

Emergency Equipment Required On Site:

- ☒ First Aid Kit
- ☒ Emergency Eye Wash
- ☐ Emergency Shower
- ☒ Fire Extinguisher
- ☐ Spill Control Media
- ☐ Other:

Investigation of Near Miss Incident and Initial Report of Incident/Exposure:

RMT employees are required to report any incident, near miss, or injury, as soon as possible, by contacting the following:

- ☒ RMT Incident Report Operator 866-902-4577
- ☒ Notify supervisor
- ☒ Notify project manager
- ☐ Notify client
  (name):
  (phone number)
- ☐ Complete client report:

The incident report submittal operator will obtain the necessary information from the employee and enter the information into the H&S incident database. All appropriate H&S, HR, and legal staff will be notified and will follow up as necessary.

Note: Pursuant to RMT's "Drug and Substance Abuse" policy (#45), RMT may require employees or subcontractors to be tested upon reasonable suspicion, following accidents or incidents during work activities, or during travel to or from a project site. Client policies may be more stringent in regard to procedures following an accident. Project managers must be aware of these and inform employees and subcontractors of any additional requirements.

Risk Analysis (RA)

(Required for all RMT field projects.)

3. Site Classification

	Identification of Potential Hazards	YES	NO	SITE TYPE[1]
1.	Is the work a Phase I ESA (i.e., supervised plant walk-through, etc.)	☐	☒	1
2.	Is the work being performed solely by a subcontractor (i.e., RMT not on site)	☐	☒	1
3.	Is the work just a supervised inspection for process evaluation, other inspections, meetings, records review, or a tour?	☐	☒	1
4.*	Is the work completely absent any chemical, physical, biological, or radiological hazards which would require a site specific health and safety plan?	☐	☒	1
5.	Does the work include any mandatory client H&S requirements?	☐	☒	1, 2, or 3
6.	Does the project include on-site work other than office type areas?	☒	☐	2 or 3
7.	Does the proposed work scope involve any of the following:			
	Known and controlled chemical or biological hazards	☒	☐	2
	Unprotected work at elevation (fall protection required)	☐	☒	2
	Invasive activities (*i.e.,* Phase II ESA, UST Removal, sampling, etc.)	☒	☐	2 or 3
	Exposure to ionizing radiation (i.e., using nuclear gauges, etc.)	☐	☒	2 or 3
	Open excavations/trenches (competent person may be required on site)	☐	☒	2 or 3
	Confined space entry (permit may be required)	☐	☒	2 or 3
	The use of scaffolding (qualified inspections are required)	☐	☒	2 or 3
	Heavy equipment	☒	☐	2 or 3
	Facility maintenance (O&M, piping, electrical, lockout/tagout, etc.)	☐	☒	2 or 3
	Underground utilities may be encountered	☒	☐	2 or 3
	Overhead utilities may be encountered	☐	☒	2 or 3
	Stack testing	☐	☒	2 or 3
	Geotechnical drilling	☒	☐	2 or 3
	Demolition Activities with known or suspected contamination	☐	☒	2 or 3
	Unknown or uncontrolled chemical or biological hazards	☒	☐	3
	Known and uncontrolled chemical or biological hazards	☒	☐	3
	Waste sampling	☐	☒	3
	Construction activities with known or suspected contamination	☐	☒	3
	Remedial activities (RCRA, CERCLA, EnviroBlend®, Oxigent, etc.)	☒	☐	3
8.	Is the work regulated by 29 CFR 1910.120 (OSHA) or 30 CFR (MSHA)?	☒	☐	3
9.	Is the work regulated by NPL, CERCLA, RCRA, TSD, or SARA?	☒	☐	3

[1] Denotes typical site level (based on activities).

Site Type Designation:

☐ **Type 1** Known and controlled hazards associated with consulting/engineering services

☐ **Type 2** Known and controlled hazards, but with invasive, hazardous activities and/or civil/mechanical construction related services, or sampling

☒ **Type 3** Unknown and/or uncontrolled hazards associated with corrective action clean-up, and/or remediation of hazardous substances

Risk Analysis (RA)

(Required for all RMT field projects.)

4. Site Characterization

Client Requirement(s)[1]:	☒ None	☐ Site Orientation	☐ H&S Orientation
	☐ Permits or Other Requirements (specify and attach, if available):		
Site Information:	☒ Map/Diagram (attach)	☐ Map/Diagram Unavailable	
	☒ Inactive Site	☐ Active Site (specify below)	
General Environmental Concerns:	☒ Contaminated Water	☐ Wastewater	☐ Dust
	☒ Contaminated Soil	☐ Solid Waste	☐ Noise
	☐ Contaminated Air	☒ Waterways	☐ Other:
Site Security/Access Control:	☐ None	☐ On Site	
	☒ Other (explain): Gated/Locked Fence		
Amenities Available for Work:	☐ None	☐ Waste Storage	☒ Restrooms
	☒ Tools/Equipment Storage	☒ Office/Trailer Space	☒ Supplies Storage
Utilities Available For Work:	☒ None	☐ As Listed:	
Medical Services Available:	☒ None On Site	☐ As Listed:	
Facility Alarms/Signals:	☒ None	☐ As Listed:	
Traffic/Parking/Railway Issues:	☒ None	☐ As Listed (On-Site/Off-Site):	
☐ Permits Required (specify)[2]:	☐ RMT:	☐ Local:	☐ State:
	☐ Federal:	☐ Other:	☒ N/A
☐ Utility Locate Service(s):	☐ On Site	☐ Client	☐ Other:
	☐ Off Site	☐ Diggers Hotline	☐ One Call
		☐ Julie, Inc.	☒ N/A

[1] If relying on the client for any specific hazard identification and control, implemented control and effectiveness should be documented prior to beginning any work activities. This is recommended for all field projects.

[2] Permit examples: Utilities (electrical, water, gas, etc.); Excavations; Explosives; Cranes; Burning; Fuel storage; Traffic control; Hoists; Cutting; Welding; Demolition; Confined space; Restricted access areas; etc.

Detailed Physical Description of Site/Facility: ☒ Map/Diagram Attached

Site Activities/Current Operations: ☒ None ☒ As Specified: Past Operations include a manufacturing facility for vinyl wall covering (1943-1987). The site was operated as an iron mine from the mid-1700's through the late 1800's.

Other Concurrent Site Activities, Work, and/or Other Adjacent Hazards or Concerns:

☐ None As Specified:

☐ Schools	☐ Daycare	☐ Hospital	☐ Airport
☒ Residential	☐ Offices	☐ Shopping	☐ Other

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

4. Hazard Evaluation

Potential Chemical, Biological, or Radiological Hazards

Complete [1] Substance Name (be specific)	Specific Applicable OSHA Standard (if any)	Physical State [2] (S, L, G, Aq, Vap, F, P)	Max. [3] Conc. Level Per Physical State	Potential Routes of Exposure [4] (Inh, Ing, Abs, Con, Ext)	Warning Properties (G, P, N)	General [5] Control Measures (Eng., Admin., PPE)	IP [6] (eV)	VP[6] (mm HG)	LEL[6] (%)	UEL[6] (%)	IDLH [7]	ACGIH TLV (C, ST,TWA) [8] (R) or (T) [9]	OSHA PEL (C, ST, TWA) [8] (R) or (T) [9]
Toluene		Aq, L, Vap	123 ppm	Inh, Abs, Ing, Con	GGPPP	PPE	8.82	21	1.1	7.1	500 ppm	500 ppm TWA	200 ppm C 200 ppm 500 ppm (10-min. maximum peak)
Xylenes		Aq, L, Vap	11 ppm	Inh, Abs, Ing, Con		PPE	8.44-8.56	7-9	0.9-1.1	6.7-7.0	900 ppm	100 ppm TWA 150 ppm STEL	100 ppm (435 mg/m3)
Ethyl Benzene		Aq, L, Vap	1.88 ppm	Inh, Ing, Con		PPE	8.76	7	0.8	6.7	800 ppm (10%LEL)	100 ppm TWA 125 ppm STEL	100 ppm (435 mg/m3)
Bis-(2-ethylhexyl) phthalate (DEHP) a.k.a. Di-sec octyl phthalate		Aq, L, S	14 ppm (Aq), 14,000 ppm (S)	Inh, Ing, Con		PPE	n/a	<0.01	0.3 (474oF)	n/a	Ca [5000 mg/m^3]	5 mg/m3 TWA	5 mg/m3
Polychlorinated biphenyl (PCB) a.k.a. Chlorodiphenyl		Aq, L, S	<100 ppb	Inh, Abs, Ing, Con		PPE	n/a	0.00006-0.001	n/a	n/a	Ca [5 mg/m^3]	0.5 mg/m3 TWA	0.5 mg/m3

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Potential Chemical, Biological, or Radiological Hazards

Complete [1] Substance Name (be specific)	Specific Applicable OSHA Standard (if any)	Physical State [2] (S, L, G, Aq, Vap, F, P)	Max. [3] Conc. Level Per Physical State	Potential Routes of Exposure [4] (Inh, Ing, Abs, Con, Ext)	Warning Properties (G, P, N)	General [5] Control Measures (Eng., Admin., PPE)	IP [6] (eV)	VP[6] (mm HG)	LEL[6] (%)	UEL[6] (%)	IDLH [7]	ACGIH TLV (C, ST,TWA) [8] (R) or (T) [9]	OSHA PEL (C, ST, TWA) [8] (R) or (T) [9]

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Potential Chemical, Biological, or Radiological Hazards

Complete (1) Substance Name (be specific)	Specific Applicable OSHA Standard (if any)	Physical State (2) (S, L, G, Aq, Vap, F, P)	Max. (3) Conc. Level Per Physical State	Potential Routes of Exposure (4) (Inh, Ing, Abs, Con, Ext)	Warning Properties (G, P, N)	General (5) Control Measures (Eng., Admin., PPE)	IP (6) (eV)	VP(6) (mm HG)	LEL(6) (%)	UEL(6) (%)	IDLH (7)	ACGIH TLV (C, ST,TWA) (8) (R) or (T) (9)	OSHA PEL (C, ST, TWA) (8) (R) or (T) (9)

(1) Use OSHA regulated name, not elemental forms. If available, attach MSDS. Identify any sample preservative or O&M chemicals or subcontractor chemicals in this table also.
(2) S = Solids, L = Liquid, G = Gas, Aq = Aqueous, Vap = Vapor, F = Fume, P = Airborne Particulate
(3) If available, attach laboratory results or summary tables.
(4) Inh = Inhalation Hazard, Ing = Ingestion Hazard, Abs = Absorption Hazard, Con = Contact Hazard, Ext = External Exposure Hazard
(5) See the following sections for detailed control measures: personal protection equipment (PPE), Air Monitoring (Admin), or Site Control (Admin and Eng.).
(6) IP = Ionization Potential, VP = Vapor Pressure, LEL = Lower Explosive Limit, UEL = Upper Explosive Limit, N/A = Not Applicable, N.D. = Not Determined
(7) IDLH = Immediately Dangerous to Life and Health. NEVER enter IDLH conditions on site without proper respiratory protection.
(8) C = Ceiling Value, ST = Short-Term Exposure Limit, TWA = Time-Weighted Average, None Est. = None Established
(9) R = Respirable Limit, T = Total Limit
(10) Warning Properties: Good (G), Poor (P), None (N)

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

4. Hazard Evaluation (continued)

Site Specific Physical Hazards

HAZARD	SPECIFIC CONTROL MEASURE

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Aboveground Storage Tanks (AST)	Be aware of any above ground storage tanks and the type of material being stored in them. Be aware of the potential of spills, fires, explosions, etc., while working near the tanks. Stay clear of tanks whenever possible, and be aware of any equipment operators near the tank(s).
☒	Animals (dogs, etc.)	Be aware of any animals on site or adjacent to the site. Appropriate care should be taken if any feral (wild) animals are encountered.
☐	Blasting/Explosives	RMT personnel shall not handle any explosive devices or materials. RMT personnel should understand the blasting procedures being used by the subcontractor, and all of the associated health & safety precautions. The subcontractor shall handle, store, and use the explosives in accordance with 29 CFR 1926.900, Subpart H and U.
☒	Boat or Barge	A boat or barge should be used that is adequately stable for the type of activity conducted. The boat or barge should have all of the appropriate and current licensing and registrations required by the applicable regulatory agencies. All applicable laws and regulations will be followed when launching the boat or barge, and when navigating to and from the work site. Personal floatation devices should always be worn while navigating the boat or barge. The boat must be equipped with the following approved United States Coast Guard (USCG) safety equipment: – A Type I, II, or III personal flotation device (PFD) for every person aboard (should be worn while navigating) The following equipment is recommended: – A Type IV throwable PFD – Audible distress signal device (air horn, whistle) – Fire extinguisher (if engine-propelled) – Auxiliary propulsion (spare paddles, trolling motor) – Bow and stern lines – Anchor and anchor line – First aid kit – Visual distress signal device(s) (flares, dyes) – Additional PFDs Be familiar with local weather and tidal characteristics. Do not conduct sampling from a boat/barge when threatening weather is imminent, or poor visibility exists. Sampling from a boat is prohibited in water containing substances likely to cause injury upon short-term or prolonged contact. Sampling from a boat is prohibited when the temperature of the water is high or low enough to cause injury upon short-term or prolonged exposure. Avoid sampling from a boat when unsafe water turbulence (waves) exists. Avoid standing in a boat. Always use the buddy system when sampling from a boat or barge; on person should be on shore with visual contact of the barge and should be able to summon emergency assistance if needed Be familiar with local weather and tidal characteristics. Work on a boat or barge will not be performed when threatening or severe weather is impending or present..
☒	Briars or Thistles	Be aware of any briars or thistles on site. Wear appropriate clothing and gloves. Avoid contact with briars or thistles whenever possible.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Business Traffic	Be aware of traffic patterns associated with local businesses near the work site. Allow traffic to enter and exit the businesses in such a manner to avoid creating traffic hazards, back-ups, delays, or potential accident situations.
☐	Cement Dust	Stay clear of mixing operations and avoid contact with, or breathing of the dust.
☐	Chain Saws	Stay clear of any chain saw operations. Subcontractor is responsible for the safe use of chain saws on site.
☒	Cleaning Agents	Use caution of applying cleaning agent to equipment. Use gloves, safety glasses, splash shields, and protective clothing as needed.
☐	Client Activities	Be aware of client activities at or adjacent to the site. Work activities should be coordinated with other site activities to avoid conflicts.
☒	Cold Stress	Work schedules may be modified when temperatures are below 20° F as measured by the wind chill factor. Take frequent breaks to warm up. Drink plenty of fluids. Wear appropriate clothing, and monitor for cold stress symptoms (frostbite, hypothermia, etc.).
☒	Compressed Air or Gas Cylinders	Compressed air or gas cylinders should be clearly marked, and they should be stored, transported, and secured in an approved manner.
☐	Compressed Air/Gas or Pressurized Liquids Hoses, Lines & Fittings	Compressed air or gas, or pressurized liquid lines or hoses should be inspected at least daily, or in the event a leak develops, or if a line or hose is run over or crimped.
☐	Concrete/Masonry/ Foundations	No construction loads shall be placed on a concrete structure or portion of a concrete structure unless a person who is qualified in structural design has determined that the structure or portion of the structure is capable of supporting the loads. All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement. No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position. To the extent practical, elevated concrete buckets shall be routed so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets. A limited access zone shall be established whenever a masonry wall is being constructed. All masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.
☐	Confined Spaces (tanks, vaults, vessels, trenches, manholes, some excavations, etc.)	The scope of this project does not entail entry into confined spaces. Confined spaces will not be entered unless a confined space entry permit has been completed, signed, and approved, and all participating personnel are trained in confined space entry procedures, including safety, and rescue procedures. Real and potential hazards of confined space are not addressed by this hazard assessment, and health and safety plan.
☒	Cutting Tools	Stay clear of contractors' cutting tools, especially saws and torches. Be aware that cutting operations could create other hazards, such as falling objects, or shifting materials, etc. Safety glasses should be worn while using cutting tools. Spark-proof tools should be used when working in areas of potential explosive or flammable conditions.
☐	Demolition Activities	Stay clear of walls, ceilings, roofs, etc., as they are being demolished.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Demolition Debris	Demolition material should only be handled by appropriate equipment because of sharp points, edges, etc. Demolition material may also pose a trip hazard, fall, or puncture hazard, so avoid walking or climbing on debris piles, etc.
☒	Drums	If drums are used on-site, they should be clearly labeled with the name of the contents. Drums should only be handled with the appropriate equipment. Drums discovered during excavations, etc., shall not be opened or moved until appropriate identification can be performed. At a minimum, Level B protection is required for sampling any unlabeled drums discovered during remediation procedures.
☐	Dust/Particulates (PNOR)(Particulates Not Otherwise Regulated) (OSHA PEL = 15 mg./m^3, total) (OSHA PEL = 5 mg./m^3, respirable)	For general dust, work should be performed up-wind if possible. If conditions warrant it, monitoring should be done with a PM-10. Monitoring should occur at least 3 times per day, and every time re-entering the site. Readings should be taken downwind from the work area or inside the equipment as indicated by the conditions on site. If the OSHA PEL is exceeded, or is likely to be exceeded, engineering or administrative controls should be used, or a dust respirator must be worn. For hazardous dusts, a detailed air monitoring plan and a respiratory protection plan should be developed for the site activities.
☐	Elevated Work	For any construction work activities elevated 6 feet or more, or other non-construction activities elevated 4 feet or more, fall protection must be provided. Caution should be taken on catwalks and ladders because of potential slippery conditions, or the potential for footwear to catch on the surfaces.
☐	Energized Sources (electrical equipment or hookups, lines, etc.,) (Lockout/Tagout)	Contractors for all electrical activities, and any facility equipment with moving parts should follow proper lock-out/tag-out procedures, and only properly trained employees will perform the work. Employees will not perform any lock-out/tag-out activities unless personnel are properly trained in lockout/tagout procedures. Heed any caution signs or labels.
☒	Equipment Exhaust	Equipment exhaust should be ventilated away from the work area while drilling inside structures. Industrial fans can be used to move exhaust out of the area.
☐	Ergonomic Issues (job hazard analysis)	Ergonomic hazards will be addressed on a site-specific basis once mobilization to the field has occurred. Workstations will be evaluated on an individual basis.
☒	Evening Work	If work is performed during the evening hours, work shall be limited by the availability and the quality of artificial lighting. Care should also be taken to avoid slip, trip, and fall hazards that are not as easy to identify during low light conditions.
☐	Excavations	Stay clear of excavation walls. RMT personnel will not enter an excavation, in accordance with 1926 Sub Part P. Subcontractor must provide a competent person on site, if one is required by the planned activities. Side cuts should conform to 1926 Subpart P requirements, or shoring should be used. All open excavations should be secured using traffic cones, barrier tape, or barricade signs stating "Do Not Enter Excavations", especially if left open overnight.
☐	Explosives	Be aware of potential explosive materials and how to identify them. No smoking is allowed on-site or near where potential explosive materials may be present.
☐	Facility Conveyors (product or waste lines)	Stay clear of facility conveyors, product process lines, and waste disposal lines. Be aware of any client specific health and safety requirements to work in these areas.
☐	Facility Equipment/Machinery	Be aware of active and moving client equipment on site.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Facility Piping - above ground	Stay clear of above ground pipes. Client is responsible to identify all applicable aboveground facility pipes prior to any work activities in the area. Pipes can be overhead hazards, or trip hazards. Pipes can be hazardous because of the material flowing through them, such as steam, natural gas, toxic chemicals, etc. Some pipes are also coated with hazardous material such as asbestos.
☐	Facility Piping - below ground	Client is responsible to identify all applicable underground facility pipe locations prior to any subsurface activities.
☐	Fall Hazard	Proper tie-off, harnesses, railings, etc. should be used when performing work on ladders, scaffolding, man-lifts, or on the roof of buildings, etc. Stay clear of the edges of pits, trenches, quarries, etc.
☐	Falling Objects	Be aware of any potential falling objects or materials on site. Stay clear of any areas identified as potential falling object areas.
☒	Fences	Be aware of fences in disrepair that may be trip hazards, or may have materials that could cause punctures or cuts. Use caution when crossing over or under fences.
☒	Field Equipment	If field equipment is heavy or awkward to carry, get assistance or use carts to help move around the site.
☒	Field Vehicle	RMT personnel shall follow all applicable state and federal traffic laws while traveling to and from the site, and while working on the site. In particular the following laws should be followed: speed limits, parking restrictions, use of wipers and lights during precipitation events, limiting cell phone use, etc. It is the responsibility of the driver to verify that all safety equipment on the vehicle is working properly before they drive the vehicle. In particular the following items should be checked: tire pressure, tire tread, windshield wipers, windshield washer, headlights, tail lights, brake lights, spare tire, fire extinguisher, first aid kit, etc.
☒	Fire Hazards	Eliminate sources of ignition in work areas that have ignitable materials. Provide an ABC fire extinguisher in close proximity to the support zone.
☒	Flooded Areas	Do not drive through flooded areas or standing water. Do not wade into moving water, or water deeper than 2 feet without adequate assistance.
☒	Flying Debris/ Eye Injuries	Be aware of any flying debris on site and wear protective eyewear when necessary.
☐	Fork Lifts	Be aware of forklift patterns, and stay clear of those routes.
☒	Hand Tools	Use only the appropriate tool for the task at hand. Use the tool(s) as designed, described, and intended by the manufacturer.
☒	Heat Stress	The work schedule may be modified if the ambient temperature is more than 80° F. Take breaks as necessary, and drink plenty of fluids. If necessary, wear sunscreen and sunglasses on bright days. Monitor site personnel for signs of heat stress symptoms (heat rash, heat cramps, heat exhaustion, or heat stroke).
☒	Heavy Equipment.	Contractor is responsible for safe operation of equipment. All mobile heavy equipment must have a functioning backup alarm, and operators must comply with equipment manufacturer's instructions. Maintain proper distance and remain in line of sight of operator and out of reach of equipment. Isolate equipment swings, if possible. Make eye contact with the equipment operator before approaching the equipment. Understand and review hand signals, and wear orange safety vest, if necessary.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Heavy Lifting	Use proper lifting procedures and equipment when handling heavy objects such as drums, manhole covers, tank covers, etc.
☐	High Pressure Gas Lines, etc.	Be aware of high pressure gas lines, and follow approved safety precautions when working with or around the lines.
☐	Highway Traffic	Traffic control within the right-of-way will be in accordance with the WDOT "Work Zone Safety – Guidelines for Construction, Maintenance, and Utility Operations" procedures. Work may be restricted within specific lanes during peak traffic times. Verify peak traffic times, and review planned activities with the WDOT, so that appropriate lane closures can be coordinated.
☒	Housekeeping	All field vehicles, job trailers, and field offices will be properly cleaned and organized to prevent cluttered work and storage areas.
☐	Hunters/Firing Range, etc.	Be aware of surrounding activities that may involve hunting, firearms, etc. that may not be in your immediate area, but could be create an unsafe work environment.
☐	Ice (thin)	When project activities include either crossing ice or working directly on the ice, a detailed plan should be developed that will be used to continually evaluate the ice conditions, and to determine when work should be terminated due to unsafe conditions. All staff working on the ice will wear an appropriate and approved personal floatation device. Other emergency equipment such as ropes, a throwable floatation device, a means to warm a wet and cold worker, etc. must be available. A buddy system should also be used for this type of work, such that one person is always on shore or at least on previously determined safe ice.
☒	Insects (ticks, bees, spiders, etc.)	Site workers with known allergies to insect bites should carry their own medication. In case of emergencies, inform fellow workers of any severe allergies. Use insect repellant as necessary, and as specifically allowed on site. If possible, wear long-sleeved shirts and pants. If appropriate, check for ticks at the end of each day. Have other appropriate first aid supplies handy for bites.
☐	Irate Neighbors	Be aware of the potential for irate neighbors or outsiders that may interfere with work activities, or that may potentially damage equipment or on-site materials, etc.
☐	Ladders	Ladders should only be used if they are in good condition, conform to OSHA requirements, and if they will be used in an appropriate manner. Be especially cautious of slipping on ladders when the ladder or footwear is wet or dirty.
☐	Landfill Gas (Methane, CO2, Hydrogen Sulfide)	Avoid breathing gas, especially in low oxygen areas (simple asphyxiant). Potentially flammable and explosive, so keep ignition sources away from gas. Explosive conditions of LEL >5% in a work area should be ventilated as soon as possible, or the area should be evacuated.
☐	Leachate (Municipal Solid Waste - MSW)	MSW leachate may contain hazardous biological substances, so avoid physical contact with leachate and, if possible, stay up-wind. If contact is made with leachate, wash affected areas thoroughly with soap and water. If boots contact leachate they should be thoroughly washed with soap and water also.
☐	Lead	Wear gloves when in contact with lead contaminated soil, etc. Thoroughly wash hands and arms when daily work is completed.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Long Hours/Fatigue	Long work hours can lead to fatigue, and fatigue can lead to the physical inability to perform the work in a safe manner, or travel to, or from, a work site in a safe manner. If long work hours are scheduled, or if the scheduled work takes longer than planned, field staff should determine if fatigue is, or will be, an issue. Field staff should evaluate whether they are able to complete the work in a safe manner, or whether they are able to travel in a safe manner. If fatigue is an issue, appropriate breaks should be planned or taken, including overnight stays when necessary.
☒	Material Handling	Move containers and heavy material only with the proper equipment, and secure them to prevent dropping, falling, or loss of control during transport. Stay clear of material handling operations, especially near slopes. Do not stand down the slope from equipment, supplies or materials being moved above on the slope, or being deployed onto the slope.
☒	Material Storage	Stored material may be a falling hazard, or a crush hazard. Do not stand adjacent to materials stacked up, such as pipes, geosynthetic rolls, etc., or in the area of deployment.
☐	Methane Gas (Landfill Gas)	Explosive conditions (5% LEL) will be ventilated, if encountered, prior to working in an area. Methane is a simple asphyxiant.
☐	Mine or Quarry	No work shall be performed within 15 feet (or other designated client setback, whichever is greatest) of the mine or quarry walls. Be aware of the potential for falling rocks or slope failures.
☐	Municipal Solid Waste (MSW)	MSW may contain hazardous biological substances, so avoid physical contact, and if possible stay up-wind. Wear appropriate PPE, such as gloves, safety shoes, and safety glasses. Wash hands, arms, and face after working near MSW. Reusable PPE and equipment should be thoroughly decontaminated after exposure to MSW. MSW may also contain sharp objects with the potential to puncture PPE.
☐	Natural Gas	Natural gas is flammable and explosive. Keep ignition sources away from gas sources. Use spark proof tools when working with gas lines, etc.
☒	Noise	Hearing protection must be worn when noise levels exceed 85 dBA in the work area. If you need to raise your voice to be heard at the work site, then hearing protection should be worn. Hearing protection will be worn near drill rigs.
☐	Overhead Hazards	Pay attention to overhead equipment, piping, and structures. A hard hat must be worn at all times when overhead hazards are present on site.
☒	Pedestrian Traffic (public, client, workers)	Be aware of pedestrian traffic patterns and, route traffic around the exclusion zone(s), as necessary, to avoid distractions and the potential for exposures or accidents. Use appropriate barricades and caution tape to mark work areas.
☒	Poisonous Plants	Be able to identify any local poisonous plants and avoid them if possible, or wear protective clothing as necessary. When removing potentially exposed clothing or PPE, the clothing or PPE should be carefully and thoroughly washed or decontaminated.
☐	Portable Heaters	Be aware of portable heater locations and stay a safe distance from them.
☒	Power Washing Equipment	Stay clear of the power washing nozzles and equipment.
☐	Propane Tanks	Be aware of propane tank locations, and any gas lines leading to or from the tanks.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Radiation (ionizing)	Exposure to ionizing radiation can be controlled by one of three methods. Time, distance, or shielding. Limit your time near the radioactive source. Keep your distance from the radioactive source. Shield yourself from the radioactive source with appropriate shielding material. If the radioactive source(s) are from RMT equipment, the RMT employee using the equipment needs required training to use the equipment, and must be monitored using a dosimeter badge.
☐	Rock Blasting	Contractor is responsible for following safe blasting protocol. Heed all contractor warnings at time of blasting and stay well clear until safe to return to area, as indicated by the contractor.
☒	Sample Preservative Chemicals:	Wear safety glasses and nitrile gloves when adding preservative chemicals to sample bottles or vials. Have clean wash water near by.
☐	Scaffolding	Stay clear of scaffolding. Be aware of the OSHA safety requirements for using constructing and scaffolding.
☒	Severe Weather	Work may be suspended if dangerous weather conditions (lightening, tornadoes, high winds, heavy rain, freezing rain, etc.) occur. Be aware of changing weather conditions, and be prepared to take shelter as necessary. Potential shelters should be identified prior to beginning work.
☒	Sharp Objects	Wear appropriate gloves when handling sharp objects, or use appropriate equipment to move objects.
☒	Slippery Ground/Surfaces	Exercise caution, especially on slopes, field trailer floors and stairs, after a precipitation event. Use slip resistant boots, or implement surface preparations to eliminate the slippery nature of the surface prior to accessing the area. Spill control measures and general housekeeping should be utilized to help prevent slipping on wet floors, wet pavement, and general work areas.
☒	Slips, Trips, and Falls:	Maintain clear walkways for work areas.
☒	Snakes	Be aware of the potential for snakes in the area and wear snake boots, snake chaps, gaiters, or leggings as needed.
☒	Steam Cleaning Equipment	Stay clear of the steam cleaning nozzles and equipment.
☐	Steel Erection	All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement. The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided. Employees engaged in steel erection activities on a walking/working surfaces with an unprotected side or edge more than 15 feet above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.
☒	Steep Slopes or Banks	Pay attention to footing and walking. Stay a safe distance from unstable or extremely steep slopes. Wear appropriate footwear. Be aware of potential slope or bank failures. Heavy equipment should not be operated on or near unstable slopes or banks.
☒	Strong Nuisance Odors	Strong odors should be ventilated before entering a work area, or a respirator shall be worn as needed.
☒	Sunburn	For extended periods of time outdoors on sunny days, sunglasses, long-sleeved shirts and long pants should be worn to help prevent sunburn and eye problems. Wear sunscreen as appropriate for the project.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☒	Surface Water	Working next to or on, bodies of water shall be done using the buddy system. Staff shall wear USCG-approved personal floatation devices when on or adjacent to bodies of water.
☒	Terrain	Uneven or steep terrain can cause hazardous conditions for walking and transporting equipment around the site. Site personnel should use caution when working on uneven surfaces, and they should avoid working down-slope from heavy equipment, or materials being moved or stored.
☒	Traffic (client, contractors, public, semi-trucks, forklifts, etc.)	Obey all posted speed limits. Park in designated areas only. Be aware of traffic patterns on site, and during access to the site. Use orange traffic cones and barrier warning tape, as needed, or if within 25 feet of the right-of-way. RMT personnel must wear orange safety vests when working in or near traffic areas..
☐	Trains/Railroad Tracks	Be aware of any train activities on the site, entering or leaving the site, or immediately adjacent to the site. Do not walk between the rails or on the railroad ties. When driving, stop at all railroad crossings, even if they are unmarked, and look in both directions before proceeding across the tracks.
☐	Transporting Hazardous Materials	RMT personnel who transport hazardous materials shall have the required DOT training prior to transporting materials, and will comply with all applicable DOT regulations and requirements for labeling, packaging, etc.
☐	Tree Cutting	Stay clear of tree cutting activities.
☐	Trenching	RMT personnel will not enter trenches not in accordance with 1926 Sub Part P. Be aware that some trenching conditions may result in a confined space condition.
☒	Trip Hazards (wires, cords, hoses, debris, corn stubble, uneven surfaces, etc.)	Temporary wires, cords, hoses, etc., should be properly located, marked, and protected to help prevent tripping and disruption to work activities. Trip hazards are particularly a problem early in the morning, late in the day, or under other poor lighting conditions.
☐	Under Ground Storage Tanks (USTs) (Septic Tanks)	If any unknown UST's are encountered, drilling or excavations will be terminated in that location until a new scope of work, Risk Assessment and Health & Safety Plan can be developed.
☒	Uneven Surfaces	Be aware of uneven walking or driving surfaces and exercise caution when moving around the site.
☐	Utilities – Overhead (electrical, telephone, cable TV, etc.)	A subcontractor, the client, or RMT will locate and identify all overhead utilities. The owner or client will be responsible for identifying all applicable overhead utilities, product lines, pipes, and aboveground tanks. A minimum clearance of 20 feet must be maintained between equipment and overhead utility lines.
☒	Utilities – Underground (electric, gas, telephone, water, storm sewer, sanitary sewer, cable TV, etc.).	A subcontractor, the client, or RMT will call Digger's Hotline to locate all underground utilities. The owner or client will be responsible for marking all applicable on-site underground utilities, product lines, pipes, and tanks.
☒	Waterways	Exercise caution near, around, or in waterways. Harnesses should be worn when working in, or within 4 feet of, the waterway, especially when attempting to sample from shore or a boat or barge. All applicable laws and regulations will be followed when navigating a boat or barge to and from a work site.

Risk Analysis (RA)

(Required for all RMT Type 2 or Type 3 field projects.)

Other Common Physical Hazards

(modify as needed, but include with all project hazard assessments)

☒	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
☐	Welding Tools	Stay clear of welding operations, and do not look directly at the welding process without appropriate eyewear and shield.
☐	Wisconsin Department of Transportation (WDOT) Work	Follow the appropriate WDOT guidelines regarding: – Work Zone Safety – Guidelines for Construction, Maintenance, and Utility Operations – Safety Directives Applicable to Subcontractor's Activities – Foot Protection – Eye Protection – Protective Headgear – Hard Hats – Confined Spaces – IHLR 32.61 – Safety Vest – Personal Safety Equipment Requirements on Railroad Property
☐	WDOT Traffic Control	**Traffic Control**: Traffic control within the right-of-way will be in accordance with the WDOT "Work Zone Safety – Guidelines for Construction, Maintenance, and Utility Operations" procedures. Work may be restricted within specific lanes during peak traffic times. Verify peak traffic times, and review planned activities with the WDOT, so that appropriate lane closures can be coordinated.

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

1. General Information

Client Name:	**PolyOne**	**Project #:**	**6527.30**	**Task #:**
Project Name:	**L.E. Carpenter Site Work**	**Project Manager:**	**Nicholas Clevett**	
Prepared By:	**Scott Pawlukiewicz**	**Date:**	**July 24, 2008**	
Approved By:	**(PM)**	**Approved By:**		**(HSC)**
	Nicholas Clevett		**Jennifer Overvoode**	
Date:		**Date:**		

Proposed Date(s) of RMT Work: **August 2008 to December 2009.**

ON-SITE PROJECT TEAM MEMBER	ON-SITE PROJECT RESPONSIBILITIES
Eric Vincke	RMT Site Health and Safety Representative (Supervisor)
	Project Engineer
Jim Dexter	Project Hydrogeologist
Eric Vincke	Project Technical Coordinator
various RMT staff	Project Scientist
various RMT staff	Observation and Documentation
various RMT staff	Soil Sampling
various RMT staff	Groundwater Sampling
	Surveying

(1) Field projects will be audited for H&S compliance if they meet the requirements of the audit program.

Any required construction/demolition activities: ☒ No ☐ Yes If Yes, complete Section 2

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

2. Construction Tasks: [work tasks to be performed by RMT staff or RMT subcontractors]

Civil

- ☐ Sewer (utility)
- ☐ Water (utility)
- ☐ Electric (utility)
- ☐ Communications (utility)
- ☐ Siding
- ☐ Roofing
- ☐ Drywall
- ☐ Flooring
- ☐ Ceilings
- ☐ Casework
- ☐ Masonry
- ☐ Escalator
- ☐ Steel (erection)
- ☐ Pre-cast (erection)
- ☐ Concrete (erection)
- ☐ Re-bar
- ☐ Elevator
- ☐ Fireproofing
- ☐ Windows
- ☐ Landscaping
- ☐ Painting
- ☐ Insulation
- ☐ Doors
- ☐ Finish Concrete

Mechanical

- ☐ Insulation
- ☐ Millwright
- ☐ Fire Protection
- ☐ Boiler
- ☐ Industrial Ventilation
- ☐ Steel Fabrication/Erection

Other

- ☐ Electrical
- ☐ Demolition (attach a detailed "**Demolition Plan**")

- ☐ Others
- ☐ Others
- ☐ Others

Estimated Direct-Hire RMT Employees:

Home Office: ☒ Not Applicable ☐ Specify:

Craft Labor: ☒ Not Applicable ☐ Specify:

Craft	Quantity
Craft	Quantity

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

3. Applicable Safety Standards or Regulations:

☒ Federal OSHA ☒ State OSHA ☐ Owner/Client

Specific Standards:	29 CFR 1910 (OSHA)	29 CFR 1926 (Other Regulations)
☒ Medical Services and First Aid	1910.151	1926.50
☐ Hazard Communication (HAZCOM)	1910.1200	1926.59
☐ Lead Exposure	1910.1025	1926.62
☒ HAZWOPER	1910.120	1926.65
☒ Personal Protective Equipment (PPE)	1910.132-138	1926.95-107
☐ Respiratory Protection	1910.134	1926.103
☐ Ventilation	1910.94	1926.57
☐ Noise Exposure	1910.95	1926.52
☐ Illumination	N/A	1926.56
☐ Fire Protection	1910.157	1926.24 and 150-155
☐ Sanitation	1910.141	1926.51
☐ Materials Handling (rigging, etc.)	1910.176	1926.250-251
☐ Welding/Cutting	1910.251-255	1926.350-354
☐ Lockout/Tagout	1910.147	1926.417
☐ Electrical (flexible cords, etc.)	1910.305	1926.400-449
☐ Scaffolding	1910.28-29	1926.450-454
☐ Fall Protection (elevated work)	1910.23-29, 1910.66-68	1926.104-107; 500-503
☐ Ladders/Stairways	1910.25-27	1926.1050 and 1060
☐ Cranes, Derricks, Hoists, Elevators, etc.	1910.179-181	1926.550-555
☐ Aerial Lifts	1910.66-68	1926.556
☐ Earth Moving Equipment	N/A	1926.602
☐ Powered Industrial Trucks (forklifts)	1910.178	1926.602
☐ Excavations and Trenching	N/A	1926.650-652
☐ Concrete and Masonry	N/A	1926.700-706
☐ Steel Erection	N/A	1926.750-761
☐ Demolition	N/A	1926.850-860
☐ Asbestos	1910.1001	1926.1101
☐ Confined Space Entry	1910.146	1926.21
☐ Commercial Diving	1910.401-441	1926.1071-1092

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

☐ Compressed Gases	1910.101-105	N/A
☐ Ionizing Radiation	1910.1096	1926.53
☐ Benzene	1910.1028	1926.1128
☐ Cadmium	1910.1027	1926.1127
☐ Tools - Hand and Power	N/A	1926.300-307
☐ Blasting and Using Explosives	N/A	1926.900-914

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

4. Training Required

(* required for all "Type 3" sites; but minimum recommended)

Check "A" if training required for everyone, and check "T" if training required for specific task.

A	T	SUBJECT	REFERENCE	
			29 CFR 1910	**29 CFR 1926 or Other**
☒	☐	HAZWOPER 40 hour*	1910.120	1926.65
☐	☒	3-Day HAZWOPER Supervised On-Site*	1910.120	1926.65
☒	☐	8-Hour HAZWOPER Refresher*	1910.120	1926.65
☐	☐	8-Hour Supervisor HAZWOPER*	1910.120	1926.65
☐	☒	First Aid, CPR*	1910.151	1926.23,.50
☐	☒	Respiratory Protection	1910.134	1926.103
☐	☐	Confined Space ☐ Permit attached	1910.146	1926.21
☐	☐	Mine Safety (MSHA)	N/A	30 CFR 48.8
☐	☐	Lockout/Tagout ☐ Permit attached	1910.147	1926.417
☐	☐	Bloodborne Pathogens	1910.1030	N/A
☐	☐	Noise Exposure	1910.95	1926.52
☐	☐	Competent Person	N/A	1926.32,.450,.650
☐	☐	Construction Health and Safety OSHA 10-Hour	N/A	1926.21
☐	☐	Demolition	N/A	1926.850
☐	☐	Excavations ☐ Permit attached	N/A	1926.650-652
☐	☐	Electrical Work	1910.332	1926.400-.449
☐	☐	Ladders/Stairways	N/A	1926.1050-1060
☐	☐	Scaffolding	1910.28	1926.450-454
☐	☐	Fall Protection	1910.23-29; 1910.66-68	1926.104,.501
☐	☐	Commercial Diving	1910.410	1926.1071-1092
☐	☐	Hot Work ☐ Permit attached	1910.251-255	1926.350
☐	☐	Lead Awareness	1910.1025	1926.62
☐	☐	Asbestos Awareness	1910.1001	1926.1101
☐	☐	Cadmium	1910.1027	1926.1127
☐	☐	Benzene	1910.1028	1926.1128
☐	☐	Ionizing Radiation	1910.1096	1926.53; 10 CFR 19.12
☐	☐	Troxler or NITON Gauge User	1910.1096	10 CFR 19.12
☐	☐	Radiation Safety Program	1910.1096	10 CFR 20.1101
☐	☐	Hazard Communication (HAZCOM)	1910.1200	1926.59
☐	☐	DOT Hazardous Materials Shipping	1910.1201	49 CFR 172.704

Client-specific training: ☒ Not Applicable ☐ Specify

Site-specific orientation: ☒ Not Applicable ☐ Specify

Competent person: ☒ Not Applicable ☐ Specify

Direct-hire employee training/certification: ☒ Not Applicable ☐ Specify

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

5. Medical Surveillance

Surveillance Required: * required for all "Type 3" sites; baseline is minimum recommended
** Specify frequency below

	29 CFR 1910	29 CFR 1926 or Other
☒ HAZWOPER Physical - Baseline*	1910.120	1926.65
☐ HAZWOPER Physical – Annual	1910.120	1926.65
☒ HAZWOPER Physical - Biennial*	1910.120	1926.65
☒ OSHA Respiratory Protection Questionnaire	1910.134	1926.103
☒ Respiratory Certification Exam	1910.134	1926.103
☐ Arsenic (urine) **	1910.1018	N/A
☐ Asbestos **	1910.1001	1926.1101
☐ Cadmium (blood) **	1910.1027	1926.1127
☐ Lead/ZPP (blood) **	1910.1025	1926.62
☐ Mercury (blood) **	N/A	N/A
☐ PCB **	N/A	N/A
☐ Vinyl Chloride **	1910.1017	1926.117
☐ Hepatitis B Vaccine (series) **	1910.1030	N/A
☐ Tetanus/Diphtheria	N/A	Stay Current
☐ Stress Test	N/A	Only as requested
☐ Visual Acuity Test	N/A	Only as requested
☐ Hearing Test (Audiometry)	N/A	Only as requested
☐ Pulmonary Function	N/A	Only as requested

Client-specific drug testing[1]: ☒ Not Applicable ☐ Specify

Client-specific medical monitoring[1]: ☒ Not Applicable ☐ Specify

Site-specific medical monitoring: ☒ Not Applicable ☐ Specify

**Frequency of medical monitoring: ☒ Not Applicable ☐ Specify

[1] Client required drug testing or medical monitoring should be coordinated through the CHSM.

Note: RMT has a "Drug and Substance Abuse" policy (#45). RMT may require employees or subcontractors to be tested upon reasonable suspicion, following accidents or incidents during work activities, or during travel to or from a project site. Client policies may be more strict in regard to procedures following an accident. Project managers must be aware of these and inform employees and subcontractors of any additional requirements.

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

6. Personal Protective Equipment (PPE)

Based on evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work tasks:

Specific RMT Job Task or Function	Minimum Level of Protection			
RMT Site Visitors—Must be escorted	☒ D			
Decontaminate all equipment using an industrial detergent (e.g. alconox) and rinse between sample locations.	☒ D	☐ C	☐ B	☐ A
Collect water elevation measurements.	☒ D	☐ C	☐ B	☐ A
Collect groundwater samples using low-flow sampling methods	☒ D	☐ C	☐ B	☐ A
Observe and document monitoring well(s) and observation point(s) installation, logs soil boring.	☒ D	☐ C	☐ B	☐ A
Level D: Safety glasses (ANSI); Safety shoes (ANSI); Nitrile gloves				
Collect soil sample(s)	☒ D	☐ C	☐ B	☐ A

Criteria for changing protection levels are as follows:

EVACUATION[2] or PROTECTION LEVEL CHANGE(3) CRITERIA	APPROVALS REQUIRED [1]		
	HSR	HSC	CHSM
Site Evacuation Plan: ☒ Not Applicable ☐ Specify or Attach Plan:			
Change to Level D when: ☐ Not Applicable ☐ Specify	☒		
Change to Level C when: ☐ Not Applicable ☐ Specify	☒	☒	☒
Change to Level B when: ☐ Not Applicable ☐ Specify	☒	☒	☒
Change to Level A when: ☐ Not Applicable ☐ Specify	☒	☒	☒

(1) HSR: Health & Safety Supervisor On Site
HSC: Health & Safety Coordinator
CHSM: Corporate Health & Safety Manager

(2) General Recommendations: Evacuate the area when LEL readings are >10% LEL in the atmosphere, or when PID readings are greater than the PEL in the breathing zone.

(3) General Recommendation: To Level C when PID readings are greater than the PEL in the breathing zone. To Level B or A only after detailed evaluation and planning.

Note: Changes to the level of protection shall be made only after the required approvals are obtained. All changes shall be recorded in the field log and reported to the Project Manager as soon as possible. RMT's H&S goal is to avoid using respiratory protection unless it is absolutely necessary or required. Administrative controls or engineering controls should always be considered as a means to reduce potential exposures, before PPE is required or considered.

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

7. Air Monitoring[1]

The following monitoring instruments shall be used on site to measure airborne contaminant concentrations in Either the breathing zone, or as part of the overall site **Air Monitoring Plan** (attach detailed plan):

MONITORING EQUIPMENT	LOCATION OF MONITORING	FREQUENCY OF MONITORING	ACTION LEVELS
☐ Combustible Gas Indicator	☐ N/A ☐ Monitoring Plan Attached ☐ Confined Space ☐ Specify	☐ Continuously when potential combustible gases or lack of oxygen are suspected. ☐ Specify	5-10% LEL: continue with caution > 10 % LEL: evacuate the area ☐ Specify
☐ O2 Monitor ☐ CO Monitor ☐ H_2S Monitor	☐ N/A ☐ Confined Space ☐ Specify	☐ Continuously when excess oxygen (>22.5%) or lack of oxygen (<19.5%) are suspected. ☐ Specify	< 19.5% Oxygen: evacuate the area; supplied air may be needed > 22.5% Oxygen: evacuate the area; potential fire hazard ☐ Specify
☐ Colorimetric Tubes Type: Type: Type:	☐ N/A ☐ Specify ☐ Sample Container ☐ Confined Space ☐ Specify	☐ Periodically during sampling for analytical purposes only ☐ Whenever noticeable odor is present ☐ Specify	☐ Specify
☒ PID Lamp Needed: ☐ 9.8 eV ☒ 10.6 eV ☐ 11.7 eV Calibration Gas: Isobutylene Correction Factor:	☐ N/A ☐ Sample Container ☐ Confined Space ☒ near breathing zone during sampling.	☒ Periodically during sampling for analytical purposes only ☐ Specify ☐ Specify ☐ Specify	☐ Specify
☐ FID	☐ N/A ☐ Specify	☐ Specify	☐ Specify
☐ Mini-RAM	☐ N/A ☐ Specify	☐ Specify	☐ Specify
☐ Other:	☐ Specify	☐ Specify	☐ Specify
☐ Laboratory Supported ☐ Personal ☐ Area ☐ Perimeter	☐ N/A ☐ Specify	☐ Specify	☐ Specify

[1] Whenever air monitoring is required to be performed, a detailed **Air-Monitoring Plan** should be developed and attached to the HSP. The plan should include **Monitoring Locations, Frequency of Readings**, and any **Action Levels** being used to control the work site.

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

8. Site Controls and Work Zones (describe in detail)

Facility Alarms or Signals: ☒ Not Applicable ☐ Specify

Work Permits Required: ☒ Not Applicable ☐ Specify

Work Traffic Issues: ☒ Not Applicable ☐ Specify

Parking Issues: ☒ Not Applicable ☐ Specify

Railway Traffic Issues: ☒ Not Applicable ☐ Specify

Support Zone(s):

☒ RMT field vehicle ☐ Job Trailer On Site ☐ Other:

Contamination Reduction Zone(s):

☒ Field vehicle ☐ Facility restroom/utility room ☐ Other:

Exclusion Zone(s):

☒ Area immediately surrounding work area ☐ Other:

Site Entry Procedures:

☒ **Notify Site H&S Representative.**

☒ **Read H&S Plan and sign Acknowledgment Statement**

☐ Check in with the facility contact person ☐ Specify

☐ Check in with facility security guard. ☐ Specify

☒ **Wear proper personal protective equipment.**

☐ Attend facility orientation ☐ Specify

☒ **Conduct daily safety meeting (document).**

☐ Other: ☐ Specify

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

Decontamination Procedures:

Personnel:

Work is to be performed in Level D or Modified Level D, and minimal contamination is expected, follow standard decontamination procedures, and good personal hygiene. Disposable PPE should be removed, contained, and disposed in an appropriate manner. Prior arrangements should be made if disposal is planned for at the project site. Site workers should plan and stage for wash water and soap at the site, prior to beginning the work. Site workers should wash hands and any exposed skin extremely well with soap and water, prior to leaving the contamination reduction zone, eating, drinking, driving, or leaving the site. Any soiled or contaminated clothing should be removed and handled appropriately, by either washing as soon as possible, or if necessary, disposing. Soiled or contaminated clothing should be carefully bagged prior to disposal or washing, to reduce potential exposure.

Equipment:

If severe contamination is expected, a specific and detailed decontamination procedure should be written to address the appropriate contamination. Site workers should plan and stage for the appropriate decontamination method at the site, prior to beginning the work. Any contaminated single-use disposable equipment or PPE should be appropriately containerized and disposed as soon as possible in an appropriate manner. Prior arrangements should be made if disposal is planned for at the project site. Contaminated equipment or PPE that will be re-used should be handled and cleaned while wearing the appropriate PPE. Typically, equipment is decontaminated using Alconox soap and de-ionized water.

Disposal of Investigation-derived Material:

☐ Leave on site for disposal.

☒ Other: RMT arranges to have IDW properly disposed of by a qualified subcontractor.

Work Limitations (time of day, buddy system, etc.):

☐ Buddy system required for some tasks Specify

☒ Work will be performed during daylight hours only

☐ Work will be performed using artificial light.

Describe or attach a lighting plan:

☒ No eating, drinking, or smoking in contamination reduction zone(s) or exclusion zone(s)

☒ When temperatures are either above 80°F or below 20°F, work schedules may be modified

☐ Other site-specific limitations:

Site Health & Safety Plan

(Required for all RMT Type 2 or Type 3 field projects.)

Radiation Safety:

- ☒ Radiation information is not applicable to this project.
- ☐ Notify RSO.
- ☐ Wear dosimeter badge when handling gauge.
- ☐ Post applicable radiation signs and documents.
- ☐ Post emergency numbers.
- ☐ Provide at least two lock systems for overnight storage.
- ☐ Maintain storage at least 15 feet from full-time workstations.
- ☐ Block, brace, and securely lock the gauge during "all" transportation.
- ☐ Limit "public" exposure to gauge while in use.
- ☐ Provide sketch of gauge storage to RSO.

Acknowledgment Statement:

As an employee of RMT, Inc., I have reviewed the Hazard Assessment (HA)/Health & Safety Plan (HSP). I hereby acknowledge that I have received the **required level of training and medical surveillance**, that I am knowledgeable about the contents of this site-specific RA/HSP, and that I will use personal protective equipment (PPE) and follow procedures specified in the HSP.

Signatures of RMT Site Personnel:

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

Health and Safety Field Audit Documentation:

If this project has been selected as a field audit candidate, the auditor will review a copy of this RA/HSP and make comments, edits, additions, or deletions on the copy. The audit copy of this document will then be forwarded to the office HSC for review. After review, the HSC will then forward the copy to the Project Manager for review and filing.

_____ (auditor) Date: _____

RMT PROJECT/FIELD SAFETY AUDIT FORM

Project Name: _____ Office Location: _____

Project Number: _____ Date of Audit: _____

	General	Yes	No	N/A	Corrective Action Notes
1	For RMT projects with temporary offices, are OSHA and job-site warning posters posted and are job-site injury records kept?				
2	Are all RMT personnel current on training requirements (i.e., 40-Hour HAZWOPER, 8-Hour Refresher)?				
3	Is training documentation for RMT employees available on site?				
4	Are appropriate RMT personnel current with medical surveillance protocol?				
5	Is at least one RMT employee on site currently trained in CPR and First Aid?				
6	Is there a stocked first aid kit located near/in job trailers?				
7	Are all containers labeled to clearly identify their contents?				
8	Are hot work zones established for hazardous waste operation and enforced?				
9	Are compressed gas cylinders being used on site properly secured?				
10	Are daily, pre-work safety meetings being held?				
	RMT Subcontractors				
11	Were subcontractors qualified for the project by using RMT's subcontractor H&S Qualification form?				
12	Are subcontractors using appropriate personal protective equipment to protect their employees?				
13	Have all non-RMT employees on site been informed as to possible hazards?				
14	Does the subcontractor have a stocked first aid kit in their job trailer?				
	RMT H&S Plan				
15	Has the H&S plan been reviewed and signed by all on-site RMT personnel?				
16	Are H&S procedures listed in the RMT H&S plan being followed by RMT personnel?				
17	Does the RMT H&S plan address all apparent hazards at this site?				
18	Is the RMT H&S plan specific to the Project operations/RMT project responsibilities?				
19	Is appropriate PPE identified on the RMT H&S plan?				
20	Is the PPE being utilized by RMT personnel as directed in the H&S plan?				
21	Are medical facilities identified on the RMT H&S plan?				

Check Yes, No or N/A for each item

For all non-compliant responses, enter description and corrective action(s) on notes page

RMT PROJECT/FIELD SAFETY AUDIT FORM

Project Name: _____ Office Location: _____

Project Number: _____ Date of Audit: _____

	Hazard Communication	Yes	No	N/A	Corrective Action Notes
22	Are MSDSs for RMT-supplied materials available?				
23	Are MSDS for subcontractor-supplied materials available?				
24	Have employees received hazard communication training?				
25	Are hazardous substances clearly marked?				
26	Is there an Emergency Response Plan in place in case of unintentional release (i.e., spill kit)?				
	Fire Protection/Prevention				
27	Is fire-fighting equipment available and in proper working condition?				
28	Have RMT personnel been trained in use of fire-fighting equipment?				
29	Are "no smoking" signs posted in appropriate locations?				
	Electrical/Power Tools				
30	Are electrical dangers posted?				
31	Are ground fault circuit interrupters used?				
32	Are terminal/discount/breaker dead front boxes equipped with covers?				
33	Have known underground/overhead utilities been identified and clearly marked?				
34	Are power tools properly grounded or double insulated?				
35	Are mechanical ties and guards in use with power tools?				
36	Is there an appropriate Lockout/Tagout (LOTO) procedure in place?				
	Ladders				
37	Are ladders inspected and properly maintained (e.g., not painted)?				
38	Are ladders properly secured to prevent slipping, sliding, or falling?				
39	Do side rails extend 36 inches above the top of the landing?				
40	Are stepladders fully open when in use?				
41	Are metal ladders being used around electrical equipment?				

Check Yes, No or N/A for each item

For all non-compliant responses, enter description and corrective action(s) on notes page

RMT PROJECT/FIELD SAFETY AUDIT FORM

Project Name: _____ Office Location: _____

Project Number: _____ Date of Audit: _____

	Scaffolding	Yes	No	N/A	Corrective Action Notes
42	Have employees received training in proper scaffold use?				
43	Is there a competent person on site?				
44	Are all connections secure and scaffold equipment in good working order?				
45	Is scaffold tied into structure when it exceeds 4 times the base width of the scaffold?				
46	Are working areas free of debris, snow, grease, ice?				
47	Are workers protected from falling objects?				
48	Is the scaffold plumb and square with cross-bracing?				
49	Are guard rails, intermediate rails, toe-boards, and end rails in place for scaffolds over 10 ft.?				
	Manholes and Permit-Required Confined Space Entry				
50	Has access and egress been provided?				
51	Has an entry permit been obtained?				
52	Have hazards been properly identified?				
53	Is air monitoring equipment on site, appropriate, calibrated, and in use?				
54	Are areas being ventilated before entry and during occupation?				
55	Have entrant, attendant, and rescue personnel been identified?				
56	Is proper rescue equipment on site? Inspected?				
57	Is appropriate lighting provided?				
	Motorized Vehicles				
58	Have operators received training?				
59	Are brakes, lights, horn, seat belts, backup lights or warning signals intact and functioning?				
60	Are personnel carried in a safe manner?				
61	Are fire extinguishers carried, if appropriate?				

Check Yes, No or N/A for each item

For all non-compliant responses, enter description and corrective action(s) on notes page

RMT PROJECT/FIELD SAFETY AUDIT FORM

Project Name: _____ Office Location: _____

Project Number: _____ Date of Audit: _____

	Excavations	Yes	No	N/A	Corrective Action Notes
62	Are excavations inspected daily?				
63	Is there any excavation entry by RMT staff?				
64	Is the competent person overseeing the trenching excavation work on site?				
65	Is shoring, sloping or benching appropriate?				
66	Is access and egress provided for employees working in excavations of 4 feet or greater in depth?				
67	Are materials stored within 2 feet of the excavation?				
68	Is the excavation barricaded?				
69	Have soils been classified (if sloping and benching is used as the protective system for employees)?				
	Water Safety				
70	Are watercraft inspected before use for leaks, damage, etc.?				
71	Is necessary emergency gear (life jackets or rings, fire extinguishers, flares, etc.) available?				
72	Are employees trained on proper safety protocols involving wading and walking in water?				
73	Are employees using the "buddy system" when taking samples in water?				
	Other Items				
74					
75					
76					
77					
78					
80					

HSC Signature: _____ **Date:** _____ **PM Signature:** _____ **Date:** _____

Check Yes, No or N/A for each item

For all non-compliant responses, enter description and corrective action(s) on notes page

RMT PROJECT/FIELD SAFETY AUDIT FORM

Notes Page

ITEM #	COMMENTS AND CORRECTIVE ACTIONS	DEADLINE FOR CORRECTION(S)	DATE COMPLETE	INITIALS

HSC Signature: _____ **Date:** _____

PM Signature: _____ **Date:** _____

Daily Safety Meeting Sign-in

Daily Hazard Review Topic:

Animals (dogs, etc.)

Briars or Thistles

Business Traffic

Cleaning Agents

Cold Stress

Compressed Air or Gas Cylinders

Cutting Tools

Drums

Equipment Exhaust

Evening Work

Fences

Field Equipment

Field Vehicle

Fire Hazards

Flooded Areas

Flying Debris/ Eye Injuries

Hand Tools

Heat Stress

Heavy Equipment

Heavy Lifting

Housekeeping

Insects (ticks, bees, spiders, etc.)

Long Hours/Fatigue

Material Handling

Material Storage

Noise

Pedestrian Traffic (public, client, workers)

Poisonous Plants

Power Washing Equipment

Sample Preservative Chemicals

Severe Weather

Sharp Objects

Slippery Ground/Surfaces

Slips, Trips, and Falls:

Snakes

Steam Cleaning Equipment

Steep Slopes or Banks

Strong Nuisance Odors

Sunburn

Surface Water

Terrain

Traffic (client, contractors, public, semi-trucks, forklifts, etc.)

Trip Hazards (wires, cords, hoses, debris, corn stubble, uneven surfaces, etc.)

Uneven Surfaces

Utilities – Underground (electric, gas, telephone, water, storm sewer, sanitary sewer, cable TV, etc.).

Waterways

Daily Safety Meeting Sign-in

Acknowledgment Statement:

As an affected employee of RMT, Inc., I hereby acknowledge that I have reviewed the contents of this site-specific HSP and the **daily safety meeting topic**, and that I will use the applicable personal protective equipment (PPE) and follow the procedures specified in the HSP.

Signatures of all onsite RMT Personnel, including Direct-Hires (Required):

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____